July 2003

Economic Analysis of Management Alternatives for Personal Watercraft in Curecanti National Recreation Area

Revised Final Report

Prepared for

Dr. Bruce Peacock
National Park Service
Environmental Quality Division

Prepared by

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1 Introduction

Historically, NPS classified PWC with other water vessels, which allowed their use when the use of other vessels was permitted. More recently, NPS has reevaluated its methods of PWC regulation. This report describes the results of an economic analysis of the proposed alternatives for regulating PWC use in Curecanti National Recreation Area (CURE).

Historically, the National Park Service (NPS) classified personal watercraft (PWC) with all other water vessels, which allowed people to use PWC when the use of other vessels was permitted by a Superintendent's Compendium.[1] In recognition of its duties under the Organic Act and NPS Management Policies, as well as increased awareness and public controversy, NPS reevaluated its methods of PWC regulation. Because of new information regarding potential resource impacts, conflicts with other users, and safety concerns associated with PWC use, NPS proposed a PWC-specific regulation in 1998. The regulation stipulated that PWC would be prohibited in units of the national park system unless NPS determines that PWC use is appropriate for a specific unit based on that unit's enabling legislation, resources and values; other visitor uses; and overall management objectives (63 FR 49,312–17, September 15, 1998). This report describes the results of an economic analysis of the proposed alternatives for regulating PWC use in Curecanti National Recreation Area (CURE), which is located west of Gunnison, Colorado.

During a 60-day comment period, NPS received nearly 20,000 comments on this proposed regulation. As a result of public comments and further review, NPS promulgated an amended regulation in March 2000. This amended regulations allows NPS to permit PWC use in 11 units by promulgating a special regulation and in an additional 10 units by amending the Superintendent's

[1] A compendium is an NPS management tool used specifically by a park superintendent to take actions to address park-specific resource protection concerns.

Compendiums (36 CFR 3.24[b], 2000). The March 2000 regulation provided park units a 2-year grace period in which PWC use could continue, after which time PWC would be banned from any park that took no action to promulgate either PWC-specific regulations or to regulate PWC use in the Superintendent's Compendium.

On August 31, 2000, Bluewater Network et al. filed a complaint with the United States District Court for the District of Columbia against NPS alleging, among other things, that the NPS rule-making decisions to allow PWC use in some park units after 2002 by making entries in Superintendent's Compendiums would not provide the opportunity for public input. In addition, the environmental group claimed that because PWC cause water and air pollution, generate noise, and pose public safety threats, NPS acted arbitrarily and capriciously when making its September 1998 and March 2000 decisions.

A settlement agreement between NPS and Bluewater Network was signed by the District Court on April 12, 2001. The agreement requires all park units wishing to continue PWC use to promulgate special regulations only after each unit conducts an environmental analysis in accordance with the 1969 National Environmental Policy Act (NEPA). At minimum, the NEPA analysis must evaluate the impacts of PWC on water quality, air quality, soundscapes, wildlife, wildlife habitat, shoreline vegetation, visitor conflicts, and visitor safety. In addition, NPS is required by federal statutes, including Executive Order 12866, to conduct a benefit-cost analysis of the proposed regulation and analyze the impact of the regulation on small businesses under the Regulatory Flexibility Act (RFA) of 1980. Based on this settlement, PWC use in CURE was to be prohibited after September 15, 2002, if a final rule permitting their use was not promulgated. However, a stipulated modification to this settlement agreement was approved by the court on September 9, 2002, that permitted PWC use in CURE until November 6, 2002. After that date, PWC use in CURE is prohibited until the final rule is published.[2] This report describes the results of an economic analysis of the proposed alternatives for regulating PWC use in

[2]Under the no-action alternative, PWC use would continue to be banned.

CURE, as required by the terms of the April 2001 settlement and by applicable federal statutes.

1.1 ORGANIZATION OF REPORT

This report presents NPS's economic analysis of the alternative CURE PWC regulations under consideration. The report is organized as follows. Section 1 describes the reason for the regulation and the current and proposed regulations at CURE. Baseline visitation, environmental conditions, and economic activity in CURE are described in Section 2. The local economic impacts on the region surrounding CURE are summarized in Section 3. Section 4 describes the methodology for assessing the impacts of the alternatives on social welfare and presents a benefit-cost analysis of the regulatory alternatives. Section 5 provides an analysis of the regulatory alternatives' impacts on small businesses. Uncertainties are addressed in Section 2 for visitation, Section 3 for regional economic impacts, and Section 5 for the alternatives' impacts on businesses. In addition, Appendix A describes the principles of economic impact analysis, and Appendix B includes a detailed theoretical discussion of the types of benefits and costs associated with PWC restrictions in national parks and the methods used in their estimation.

1.2 PROBLEM ADDRESSED BY REGULATION

In general, regulations should be imposed only where a market failure exists that cannot be resolved efficiently by measures other than federal regulation.

The U.S. Office of Management and Budget (OMB) directs regulatory agencies to demonstrate the need for their rules (OMB, 1992). In general, regulations should be imposed only where a market failure exists that cannot be resolved efficiently by measures other than federal regulation. If each producer and consumer has complete information on his or her actions and makes decisions based on the full costs of those actions, resources will be allocated in a socially efficient manner. However, when the market's allocation of resources diverges from socially optimal values, a market failure exists. A defining feature of a market failure is the inequality between the social consequences of an action and a purely private perception of benefits and costs. The major causes of market failure identified in the OMB guidance on Executive Order 12866 are externalities, natural monopolies, market power, and inadequate or asymmetric information. For environmental problems

resulting from market failures, this divergence between private and social perspectives is normally referred to as an externality. Such divergences occur when the actions of one economic entity impose costs on parties that are external to, or not accounted for in, a market transaction or activity.

The justification for restricting PWC use in national parks is based on externalities associated with their use.

The justification for restricting PWC use in national parks is based on externalities associated with their use. For instance, the operation of PWC imposes costs on society associated with noise emissions, air and water pollution emissions, and health and safety risks. Because PWC users have little incentive to consider these external costs, they are likely to make decisions about PWC use without taking these impacts on other people into account.

If these externalities are internalized to the PWC users generating them, the problem can be mitigated. For example, if PWC users were required to pay for the marginal external costs they impose on others, they would begin to take those costs into account when making decisions and the market failure would be corrected. However, accurately assigning costs associated with each individual PWC user's actions and enforcing payment are essentially not feasible at this time. Other regulatory options to address the externalities associated with PWC use are far easier to implement and enforce. Some of these options include restricting areas where they are permitted, the time of day when they can be used, and PWC engine type.

Although non-PWC users gain from PWC restrictions, the PWC users and local businesses that serve them experience welfare losses.

The extent to which social welfare improves because of PWC regulation depends on the relative benefits and costs associated with such restrictions. Although non-PWC users gain from PWC restrictions, the PWC users and local businesses that serve them experience welfare losses. Thus, the likelihood that a particular regulatory option will improve social welfare in an individual national park unit depends on numerous park-specific factors that influence the level of benefits and costs. Although a given set of restrictions on PWC use in one park may improve social welfare, the same set of restrictions in another park could easily have negative impacts on social welfare. For example, banning PWC in a park where there is little other motorized boating activity may result in large proportionate reductions in noise and emissions, whereas banning PWC in a park with a high level of other motorized boating activity may not have a noticeable effect on noise or emissions

levels. In the latter case, the costs to PWC users could be larger than the gains to other park visitors. Thus, it is important to consider the conditions specific to each individual park in selecting the preferred regulatory alternative for that park.

1.3 CURRENT PWC ACTIVITIES AT CURE

PWC use is currently prohibited in CURE (including operating, transiting, launching, and beaching). In accordance with the September 9, 2002, stipulated modification to the April 2001 settlement agreement, PWC use in CURE was prohibited after November 6, 2002, unless a final rule authorizing its use is promulgated. For the purposes of the analyses provided herein, a ban on PWC use within CURE is considered the baseline condition. A map of CURE is presented in Figure 1-1.

1.4 PROPOSED REGULATIONS

The following three alternatives are being considered for the management of PWC in CURE:

Proposed Regulations for PWC Use in CURE

Alternative A: Reinstate PWC Use as Previously Managed Under a Special Regulation

Alternative B: Reinstate PWC Use as Previously Managed Under a Special Regulation, but with Additional Management Prescriptions

Alternative C: No-Action Alternative (Continue PWC Ban)

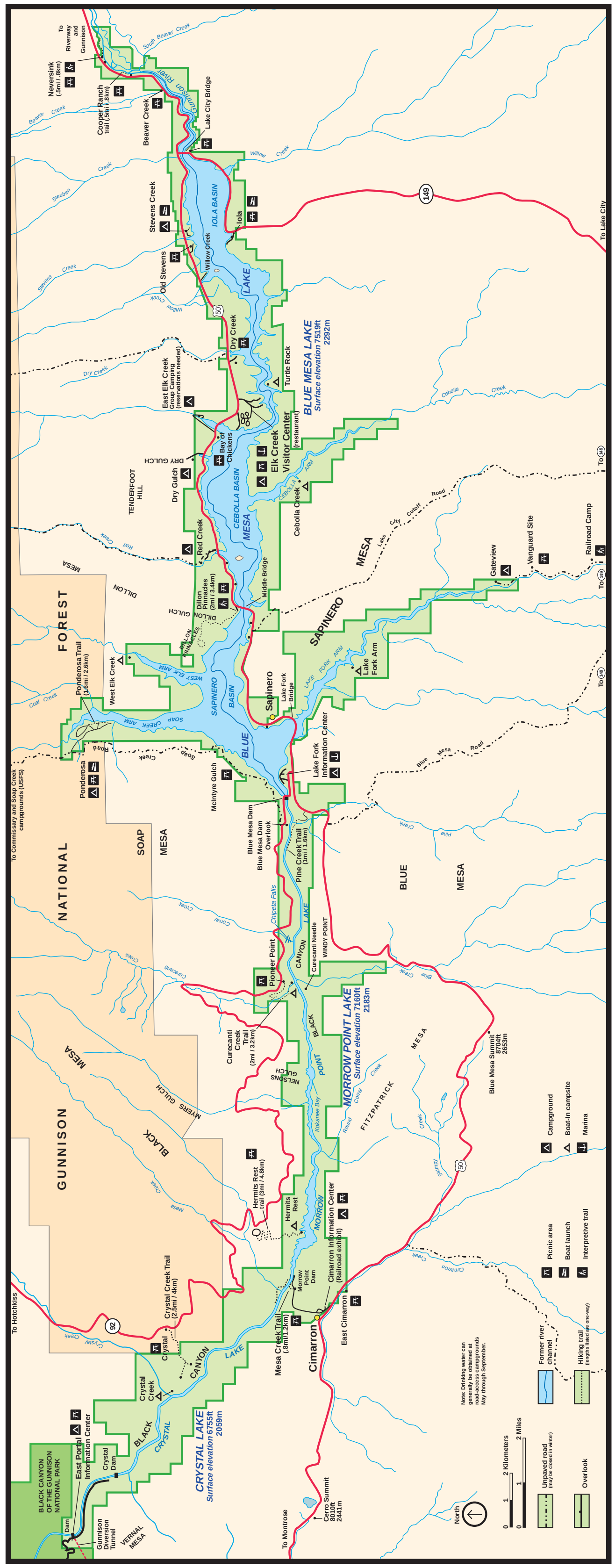
Alternative A: Reinstate PWC Use as Previously Managed Under a Special Regulation

PWC use would be reinstated in all locations in CURE where it was allowed through November 6, 2002. PWC use would be reinstated through a special regulation and would be managed consistent with management strategies, as outlined in the Superintendent's Compendium (NPS, 2002d) and in applicable state regulations in effect.

As prescribed by CURE's General Management Plan (NPS, 1997) and the Superintendent's Compendium (NPS, 2002d), PWC use would occur in areas of Blue Mesa Reservoir and portions of the lake arms. Areas appropriate for PWC use would include Sapinero; Cebolla and Iola Basins; Bay of Chickens; Dry Creek; Elk Creek; the Highway 149 area; and Lake Fork, Soap Creek, and West Elk arms.

Operation of all motorized watercraft would continue to be prohibited in areas east of Beaver Creek within the Gunnison River Canyon and in the area downstream from the East Portal diversion

Figure 1-1. Curecanti National Recreation Area



dam. The following areas would remain closed to all boating, including PWC, and shoreline entry:

- Blue Mesa Dam downstream for 225 yards
- Morrow Point Dam downstream for 130 yards
- Crystal Dam downstream for 700 yards
- East Portal diversion dam upstream for 60 yards

PWC would be regulated by a 25-horsepower watercraft limit in Morrow Point Reservoir and Crystal Reservoir.

The following areas would remain flat-wake speed areas:

- the area upstream from Lake City Bridge to Beaver Creek
- the most inland and narrow portions of Soap Creek Arm, West Elk Arm, Lake Fork Arm, and Cebolla Arm
- narrow waterways off the Bay of Chickens and Dry Creek
- Elk Creek and Lake Fork Marinas and Iola and Stevens Creek boat launch areas

All designated launch areas on Blue Mesa Reservoir (developed and unimproved) would remain open to PWC use. PWC would be allowed to land on any shoreline at Blue Mesa Reservoir. All state and federal watercraft laws and regulations would continue to be enforced.

The existing monitoring program would continue to measure resource changes and impacts. Resources to be monitored would include, but would not be limited to, water quality, shoreline erosion, Gunnision sage grouse, bird presence and abundance, and visitor use patterns.

Alternative B: Reinstate PWC Use as Previously Managed Under a Special Regulation, but with Additional Management Prescriptions

Alternative B is the same as Alternative A with the following management prescriptions:

- A 100-foot buffer zone would be created along the south shore of Blue Mesa Reservoir that stretches from 0.5 miles west of Iola to 0.5 miles east of Middle Bridge for soundscape quality, cultural resource protection, wildlife protection, and erosion prevention. A second 100-foot buffer zone would be established at the Stevens Creek campground for the protection of an active Gunnison sage

grouse lek and nesting area. Buffer areas would be zoned as flat-wake speed areas.

- Areas from the mouth of the lake arms on Blue Mesa Reservoir upriver to the point where noise or speed affects visitor safety, wildlife, or soundscapes would be managed for no-wake or idle speeds within 150 feet of another boat, a person in or floating on the water, a water skier (except those being towed), shore fisherman, a launching ramp, a dock, or a designated swimming area. Flat-wake speed zones would be established from this point upriver to the river inlet.
- Existing resource conditions and a monitoring program would be established to measure resource changes and impacts as a result of PWC use.
- A voluntary user education program would be established and would include interpretive talks, on-site bulletins, brochures to PWC registrants, and visitors who rent PWC.

Alternative C: No-Action (Continue PWC Ban)

Under the no-action alternative, no unit-specific rule would be developed to reinstate PWC use in CURE. Therefore, PWC use would be prohibited in CURE permanently, in accordance with Bluewater Network v. Stanton, No. CV02093 (D.D.C. 2000), the settlement agreement approved by the court on April 12, 2001, and subsequent September 9, 2002, modification.

2 Description of PWC Use in Curecanti National Recreation Area

PWC use in CURE could have negative impacts on water and air quality, soundscapes, wildlife and wildlife habitats, and cultural and ethnographic resources.

CURE, located in southwestern Colorado (see Figure 1-1), was established in 1956 with the passage of the Colorado River Storage Project Act. The reservoir was created by Congress for the purposes of reclaiming of arid lands, regulating river flow, controlling floods, storing and delivering water for beneficial consumptive uses, providing public outdoor recreation, improving conditions for fish and wildlife, and providing hydroelectric power. CURE was created by Section 8 of the Act to provide public recreational facilities; to conserve scenery, wildlife, and natural, historic, and archeological objects; to provide for public use and enjoyment of the lands and water areas at CURE; and to provide facilities to mitigate losses of, and improve conditions for, the propagation of fish and wildlife.

CURE consists of 41,972 acres, including three man-made lakes named for their corresponding dams on the Gunnison River: Blue Mesa Reservoir, Morrow Point Reservoir, and Crystal Lake Reservoir. Blue Mesa Reservoir, over 20 miles long with 96 miles of shoreline, is Colorado's largest water body and is the largest Kokanee Salmon fishery in the United States. Dinosaur fossils, a 5,000-acre archaeological district, and Native American dwellings are also found within CURE boundaries.

2.1 PWC USE, AREA ACCESS, MAINTENANCE, AND ENFORCEMENT AT CURE

Although PWC use is currently banned in CURE (See Section 1.3), this section reviews PWC access, maintenance, and enforcement prior to the ban. PWC were first used in CURE prior to 1995 in very limited numbers. In 1995, a concessionaire at CURE began renting PWC on Blue Mesa Reservoir, and PWC use increased since that time until the ban went into effect in November 2002. The typical PWC use season lasted from Memorial Day to Labor Day with the highest use in June, July, and August.

Facility maintenance and law enforcement activities associated with PWC use at CURE were incidental to other park services. Motor vessel access to Blue Mesa Reservoir is provided by two marinas and three additional paved launch ramps (see Figure 1-1). The marinas with launch facilities are located at Lake Fork and Elk Creek. Launch ramps with no marinas or associated services are located at Ponderosa, Stevens Creek, and Iola.

NPS personnel are the primary enforcement agents of state and federal regulations on the lakes, but Colorado State Park staff occasionally visit the lakes on busy weekends. The Colorado Division of Wildlife generally enforces fishing regulations. CURE currently has six permanent law enforcement staff and two boats. Generally, one boat with one person is on the lake daily during daylight hours in the summer season. Incident responses and night patrols generally involve two staff in a boat. If regulations restricting the use of PWC are adopted, park staff have indicated that enforcement patrols would not have to be increased because the existing daily patrols are sufficient to enforce the regulations for the low number of PWC used prior to the ban at CURE.

The number of boating accidents at CURE is very small relative to the number of boats, and none of the accidents reported between 1998 and 2001 involved PWC, although CURE has issued citations to PWC operators. The most common infraction was violation of no-wake restrictions at marinas. Although there were only nine PWC citations in the last 5 years, the share of PWC in all watercraft citations was disproportionately large; PWC accounted for approximately 18 percent of all watercraft citations but less than 1 percent of total watercraft over the period. Table 2-1 summarizes

Table 2-1. CURE Watercraft Accidents and Citations, 1998–2002

Year	All Watercraft Accidents	PWC Accidents	All Watercraft Citations	PWC Citations
1998	6	0	14	3
1999	5	0	8	3
2000	4	0	8	0
2001	7	0	5	1
2002	2	0	15	2

Source: National Park Service (NPS). 2003. *Curecanti National Recreation Areas Personal Watercraft Use Environmental Assessment.* Washington, DC: National Park Service.

accident and citation data at CURE. CURE staff received several complaints from fisherman regarding PWC use, but use conflicts were relatively minor because of the small number of PWC on the lake prior to the ban.

2.2 VISITATION DATA

In Sections 3 and 4, NPS presents analyses of the economic impacts and the social benefits and costs of PWC use under alternative regulations in CURE from 2003 through 2012. To support the development of these estimates, Section 2.2 presents projections of baseline PWC and non-PWC visitation for this period and discusses the methodology used to calculate the projections. The projected baseline represents visitation to CURE after imposition of the ban on PWC use, as discussed in Section 1.3. In addition, projected visitation expected to have occurred in the absence of the ban is presented.

2.2.1 Historical CURE Visitation Data

NPS reports that recreational visitation in the year 2001 was an estimated 879,776 people, with peak visitation in June, July, and August. Table 2-2 presents the 2001 monthly visitation estimates for CURE. Approximately 455,132 people visited CURE from June through August, accounting for approximately 52 percent of annual visitation.

Only a small portion of visitors to CURE uses Blue Mesa Reservoir or the campgrounds that are close to the lake. NPS staff at CURE estimate that approximately 51,500 visitors in 2001 were boaters, shoreline visitors, or visitors to the campgrounds close to Blue Mesa

Table 2-2. Monthly Recreational Visitation to CURE, 2001

Month	Recreational Visits
January	16,627
February	14,273
March	20,180
April	32,103
May	82,353
June	141,263
July	124,419
August	189,450
September	111,863
October	72,758
November	57,452
December	17,035
Total	879,776

Source: National Park Service (NPS). 2002b. "Visitation Records." <http://www.nps.gov>. As obtained in April 2002.

Reservoir, or less than 6 percent of 2001 total visitation (NPS, 2002c). It is this portion of visitors that will be most affected by restrictions on PWC use.

2.2.2 Historical CURE Watercraft Visitation Data

Based on angler surveys conducted in cooperation with the Colorado Division of Wildlife, an average of 20,398 boats were used annually on Blue Mesa Reservoir between 1993 and 2000 during the May to September boating season. NPS staff estimate that prior to the ban, approximately five PWC used CURE on a weekday and 10 PWC used Blue Mesa Reservoir on a weekend day or holiday (NPS, 2002c). NPS staff indicated that, historically, the season for PWC was from Memorial Day to Labor Day. As shown in Table 2-3, visitation to CURE was lower in 2001 than in previous years (as with 2001, 1995 and 1997 totals are slightly different than presented in Table 10 of the 2003 Environmental Assessment (EA). According to CURE officials, PWC use was also lower in 2001 than in previous years. NPS staff attributed this decline in visitation to relatively high gasoline prices (NPS, 2002c).

Table 2-3. Annual Recreational Visitation to CURE, 1979–2001

Year	Total Visitation	Year	Total Visitation
1979	809,007	1991	1,090,929
1980	891,490	1992	1,098,183
1981	988,951	1993	1,089,098
1982	994,265	1994	1,064,538
1983	1,050,217	1995	993,072
1984	994,143	1996	1,017,256
1985	1,071,782	1997	966,680
1986	1,114,756	1998	973,652
1987	1,096,823	1999	1,044,523
1988	1,076,510	2000	1,022,320
1989	1,125,447	2001	879,776
1990	1,102,283		

Source: National Park Service (NPS). 2002b. "Visitation Records." <http://www.nps.gov>. As obtained in April 2002.

NPS estimated total PWC visitation using the following assumptions:

- five PWC visited CURE on a typical weekday, prior to the ban on PWC;
- 10 PWC visited CURE on a typical weekend day or holiday, prior to the ban on PWC;
- 34 weekend or holiday days and 67 weekdays in a typical PWC season (based on the 2001 calendar year); and
- 3.67 people per PWC (based on the average of estimates from Glen Canyon National Recreation Area, Big Thicket National Preserve, and Lake Meredith National Recreation Area) (MACTEC, BBL, and RTI, 2002a,b,c).

Using these assumptions, NPS estimates 2001 PWC use at 675 machines and 2,475 PWC users.

Historically, the average PWC user was a local day visitor or a renter, although some users camped and launched their PWC from shore. Visitors to CURE included those exclusively using PWC as well as those who also brought fishing boats. Many visitors to CURE are summer residents who live in other states. Because very few PWC are available for rent in CURE, most PWC users that visited the park prior to the ban likely used their own machines. PWC rentals were available at the marina on Blue Mesa Reservoir,

Absent additional information on PWC use in CURE, NPS assumes that CURE park staff have the best available data on total PWC visitation to the park.

but the concessionaire there had only three PWC. These PWC were rented by the hour, half-day, or full day, and the concessionaire indicated that all machines were typically rented out on weekends. NPS staff were not aware of rental shops in the nearby towns of Gunnison and Montrose, Colorado.

Absent additional information on PWC use in CURE, NPS assumes that CURE park staff have the best available data on total PWC visitation to the park. Thus, CURE park staff estimates of PWC use are the primary values used in the economic analyses.

2.2.3 Projected Visitation

Methodology for Projecting Visitation

To project PWC and non-PWC visitation for the years 2003 through 2012, NPS used the following methodology:

Baseline

1. Calculate average recreational visitation over the five most recent years with data available (1997–2001).
2. Divide the recreational visitation estimated in Step 1 between PWC and non-PWC visitation using estimates of PWC use in 2001 relative to total recreational visits.
3. Project baseline non-PWC visitation for the period 2003–2012 by allowing non-PWC visitation to change from the 1997–2001 average at the population growth rate for the areas from which most visitors to the park originate. The average annual growth of the regional population is expected to be 2.0 percent.
4. Assume there would be no PWC use in 2003–2012 under baseline conditions because of the current ban on PWC use in CURE.
5. Project visitation by former PWC users by assuming a certain fraction will continue to visit CURE to engage in activities other than PWC use following the ban. In the absence of survey data, these percentages will typically be based on professional judgment.

Without Ban

1. Calculate average recreational visitation over the five most recent years with data available (1997–2001).
2. Divide the recreational visitation estimated in Step 1 between PWC and non-PWC visitation using estimates of PWC use in 2001 relative to total recreational visits.

3. Estimate PWC visitation for 2003–2012 by using the estimates of annual growth in PWC use presented in the EA of PWC use at CURE (NPS, 2002). Although the number of PWC owned and sold are declining nationally (NMMA, 2002a,b), local trends are assumed to be a better source of data for projecting PWC use than national trends because locals comprise the majority of PWC users at the park.[1] The EA methodology projects the annual growth in PWC visitation to be 2.0 percent based on a combination of the trends in local population, where most PWC users at CURE are believed to come from, and in local PWC and boating registrations.

Projecting Visitation for 2003 through 2012

Following the methodology outlined above, NPS calculated CURE average annual recreational visitation for 1997 through 2001 to be 977,390. According to NPS estimates, approximately 0.28 percent of 2001 visitors used a PWC in CURE. Assuming that the percentage of visitors using PWC remains relatively constant over time, this implies an annual average of 2,750 PWC users and 974,640 non-PWC users from 1997 to 2001.

As described above, NPS projects that non-PWC visitation will grow at the rate of population growth for the area surrounding CURE. In the absence of a ban, visitation by PWC users was projected based on previous population and historic PWC and boating registration information. NPS believes that most visitors to the park originate from local areas. Based on state demographic data, average annual increases in population for Colorado, Region 10, and the Front Range of Colorado (major metropolitan areas in the state) are projected to be approximately 1.7 percent to 2.0 percent for the years 2000 through 2015. Region 10, which includes the counties surrounding CURE, is projected to experience 2.0 percent population growth per year.[2]

Under baseline conditions, there is assumed to be no PWC use in the park because PWC are banned in the baseline. However, many of the former PWC users who can no longer use a PWC in CURE

[1] In analyses of PWC regulations in other national parks, NPS has typically relied on the national data because of a lack of park-specific information. However, where local information is readily available, NPS prefers the local data because it is expected to more accurately reflect conditions at a particular park.

[2] Region 10 is composed of six counties in the vicinity of CURE: Delta, Gunnison, Hinsdale, Montrose, Ouray, and San Miguel.

may continue to visit the park to pursue other types of recreation. It was assumed that 80 percent of PWC users would continue to visit the CURE park region under the ban. This percentage is based on professional judgment and reflects the lack of nearby alternative recreation opportunities. Based on the estimated regional population growth rate and the assumed percentage of former PWC users who stop using PWC in the park who will continue to visit the park for other activities, NPS presents the projected baseline visitation for CURE from 2003 to 2012 in Table 2-4.

Table 2-4. Projected Baseline Visitation to CURE, 2003–2012[a]

		Non-PWC Users			
Year	PWC Users	Non-PWC Users in the Absence of the Ban	Visitors that Would Have Used PWC in the Absence of the Ban[b]	Total Non-PWC Users	Total Visitation
2003	0	1,014,016	2,289	1,016,305	1,016,305
2004	0	1,034,296	2,289	1,036,585	1,036,585
2005	0	1,054,982	2,289	1,057,271	1,057,271
2006	0	1,076,082	2,289	1,078,370	1,078,370
2007	0	1,097,603	2,289	1,099,892	1,099,892
2008	0	1,119,555	2,289	1,121,844	1,121,844
2009	0	1,141,946	2,289	1,144,235	1,144,235
2010	0	1,164,785	2,289	1,167,074	1,167,074
2011	0	1,188,081	2,289	1,190,370	1,190,370
2012	0	1,211,843	2,289	1,214,131	1,214,131

[a]These projections are based on the estimated regional population growth rate, the projected change in PWC ownership, and the assumed percentage of former PWC users who voluntarily stop using PWC in the park that will continue to visit the park for other activities. There is no PWC use in the park after November 2002 under the baseline conditions because PWC were banned on that date.

[b]This category represents visitors who would have used PWC in CURE in the absence of the ban, but would continue to visit the park to engage in alternative activities following the ban. These values were calculated based on an assumption that 80 percent of those people that would have used PWC in the park in the absence of the ban would continue to visit the park to engage in alternative activities. It was also assumed that all of the visitors that were willing to switch to alternative activities in the first year after the ban (2003) would be willing to continue visiting in all future years, while those that did not switch in the first year would not do so in future years either.

To estimate the incremental impacts of the alternative management strategies (see Sections 3 and 4), the change in visitation relative to these baseline conditions must be projected. Table 2-5 presents the

Table 2-5. Projected Visitation to CURE in the Absence of the Ban on PWC Use, 2003–2012

Year	PWC Users	Non-PWC Users	Total Visitation
2003	2,861	1,014,016	1,016,877
2004	2,918	1,034,296	1,037,214
2005	2,977	1,054,982	1,057,959
2006	3,036	1,076,082	1,079,118
2007	3,097	1,097,603	1,100,700
2008	3,159	1,119,555	1,122,714
2009	3,222	1,141,946	1,145,168
2010	3,287	1,164,785	1,168,072
2011	3,352	1,188,081	1,191,433
2012	3,419	1,211,843	1,215,262

projected visitation that would have taken place in the absence of the November 2002 ban on PWC use in CURE.

2.2.4 Uncertainty

NPS estimates of PWC and non-PWC use in the years 2003 through 2012 are based on a number of assumptions. In addition, a variety of unpredictable circumstances could affect visitation in a particular year. In general, visitation to CURE in a specific year will depend on many factors, including

- economic conditions,
- weather,
- water levels and other similar resource conditions,
- national and state regulations that may affect PWC use or prices, and
- alternative recreational activities available.

Although many of these factors are difficult to predict, a recent regulation enacted by the U.S. Environmental Protection Agency (EPA) in 1996 may affect PWC use nationally and in CURE. The 1996 EPA rule for New Gasoline Spark-Ignition Marine Engines (hereafter referred to as the 1996 EPA Marine Engine Rule) requires PWC (and other spark-ignition [SI] marine engine) manufacturers to reduce emissions by 75 percent from the 1998 model year by the 2006 model year (*Federal Register*, 1996). In their analysis of the

rule, EPA predicted that the emissions from all of the regulated engines in use will decrease by approximately 75 percent from baseline emission levels by the year 2025. The delay in actual emission reductions for machines in use is due to the long lives of some marine engines. EPA predicts that complete fleet turnover for some engines may not occur until 2050. However, EPA assumes that the life cycle for PWC is 10 years, considerably shorter than their assumptions for the life cycles of some of the other SI marine engines covered by the rule (*Federal Register*, 1996). According to the Personal Watercraft Industry Association (PWIA), PWC manufacturers have already reduced the emissions of PWC significantly, and many of the newer PWC models already comply with the 1996 EPA Marine Engine Rule (PWIA, 2002a).

It is also possible that publicity surrounding the proposed NPS PWC rules may have affected PWC. PWC sales have been declining nationally over the past few years. However, the sales decline began in 1996, which is before NPS first proposed rules restricting PWC in national parks. This suggests that other factors also may be involved in the national recent sales decline. Nonetheless, it is possible that baseline PWC use would have been higher in the absence of the recent negative publicity.

Without additional data, it is difficult to predict whether the assumptions used by NPS will bias the projections upward or downward.

NPS identified the following additional uncertainties in the projections of baseline visitation:

- The estimate of 2001 PWC use represents the park's best estimate of use. However, CURE staff have not conducted a rigorous count of PWC throughout the season.
- NPS projects growth in visitation for both PWC users and nonusers based on previous population and PWC and boating registration information. Although a number of factors could affect visitation in any one year or the trends in visitation over time, NPS believes that the methods adopted provide the best available proxy for changes in visitation to CURE.
- NPS makes assumptions about the number of PWC users who will return in the future under the existing ban. These assumptions represent our best estimate, but the actual percentage of former PWC users who continue to visit the park for alternative recreation activities may be higher or lower.

2.3 ALTERNATE LOCATIONS FOR PWC USE IN THE COLORADO REGION

Alternate locations for PWC use in the vicinity of CURE are limited, largely because nearby lakes such as Ridgeway Reservoir are high-elevation, cold-water lakes and therefore are not ideal for PWC use.

The closest NPS units with significant PWC use include Glen Canyon NRA, located approximately 150 miles west of CURE, and Lake Mead NRA, located approximately 400 miles west.

2.4 OTHER MAJOR SUMMER ACTIVITIES IN CURE

Summer recreation activities in CURE include wildlife viewing, day hiking, bird watching, kayaking, canoeing, diving, visiting geological sites, visiting historic sites, backpacking, windsurfing, fishing, hunting, and recreational tours. Other than complaints from boating and nonboating fisherman, CURE staff have not observed many conflicts between PWC users and other visitors. According to NPS staff at CURE, fishing is the primary activity for those visitors using Blue Mesa Reservoir (NPS, 2002a).

2.5 NATURAL RESOURCES AND LIKELY ECOLOGICAL IMPACTS OF PWC USE IN CURE

The following section provides an assessment of the natural resources at CURE and the potential impacts to park resources under the proposed PWC management alternatives identified in Section 1.4. NPS conducted an impairment analysis to assess the magnitude of impacts to park resources under various PWC management alternatives. Details of this analysis, including guiding regulations and policies as well as methodologies and assumptions, are described in the *Curecanti National Recreation Areas Personal Watercraft Use Environmental Assessment* (NPS, 2003) for CURE. Conclusions based on the impact analysis for each alternative are presented below. Impacts are assessed using current conditions as baseline and comparing them with the proposed alternatives (see Section 1). The following impact thresholds were established in the CURE EA to describe the relative changes in resources:

- Negligible: Impacts are not detectable, below resource standards or criteria, and within historical or baseline conditions of the park.
- Minor: Impacts would be detectable but would be below the resource standards or criteria and within historical or desired conditions of the park.
- Moderate: Impacts would be detectable but at or below the resource standards or criteria; however, conditions would be altered on a short-term basis.
- Minor: Impacts would be detectable but would be below the resource standards or criteria and within historical or desired conditions of the park.
- Major: Impacts would be detectable and frequently altered from historical or baseline conditions in the park and would exceed resource standards or criteria slightly and singularly on a short-term and temporary basis.
- Impairment: Impacts would be detectable and substantially and frequently altered from historical or baseline conditions in the park and would frequently exceed resource standards or criteria on a short-term and temporary basis. The impacts would involve deterioration of the park's resources over the long term, to the point that the park's purpose could not be fulfilled.

Impacts have been assessed using current conditions (i.e., the PWC ban) as the baseline and comparing them with the conditions likely under the proposed alternatives (see Section 1.4). Cumulative impacts from all sources are described where they differ from PWC-specific impacts.

2.5.1 Water Quality

Most research on the effects of PWC use on water quality focuses on the impacts of two-stroke engines and assumes that impacts caused by these engines also apply to the PWC powered by them. The typical conventional (i.e., carbureted) two-stroke PWC engine intakes a mixture of air, gasoline, and oil into the combustion chamber; expels exhaust gases from the combustion chamber; and discharges as much as 30 percent of the unburned fuel mixture as part of the exhaust (California Air Resources Board, 1999). At common fuel consumption rates, an average 2-hour ride on a PWC may result in the discharge of 3 gallons (11.34 liters) of fuel into the water (VanMouwerik and Hagemann, 1999).

Contaminants released into the environment as a result of PWC use include those present in the raw fuel itself and those that are formed

during its combustion. Fuel used in PWC engines contains many hydrocarbons (HCs), including volatile organic compounds (VOCs) such as benzene, toluene, ethylbenzene, and xylene (collectively referred to as BTEX) and methyl tertiary butyl ether (MTBE). Unburned PWC fuel does not contain appreciable levels of polycyclic aromatic HCs (PAHs), but several PAHs are formed as a result of its combustion (i.e., phenanthrene, pyrene, chrysene, benzo(a)pyrene, and acenapthylene) (VanMouwerik and Hagemann, 1999). Other HCs that are not present in PWC fuel but are by-products of incomplete combustion include formaldehyde, acetaldehyde, diesel particulate matter (PM), and 1,3-butadiene (EPA, 1994).

Unburned fuel and combustion by-products are released to the environment in PWC exhaust. Because of differences in chemical and physical characteristics, BTEX released into the water readily transfers from water to air, whereas most PAHs and MTBE do not. Therefore, water quality issues associated with BTEX in the water column are less critical than those associated with PAHs and MTBE (VanMouwerik and Hagemann, 1999).

Compounds released in water as a result of PWC use are known to cause adverse health effects to humans and aquatic organisms. Exhaust emissions from two-stroke engines have been specifically shown to cause toxicological effects in fish (Tjarnlund et al., 1995, 1996; Oris et al., 1998). Sunlight can further increase the toxic effect of PAHs to aquatic organisms (Mekenyan et al., 1994; Arfsten, Shaeffer, and Mulveny, 1996). Research evaluating the possible phototoxic effects of some PAHs to aquatic organisms (NCER, 1999) has demonstrated that toxicity may vary due to a number of factors including length of exposure; turbidity, humic acid, and organic carbon levels; the location of the organism relative to the surface of the water or the sediment; and weather (NCER, 1999). For instance, increased turbidity or organic carbon tended to reduce toxicity, while increasing the length of exposure tended to increase toxicity and proximity to the surface might increase toxicity (i.e., shallow waters).

New PWC engines, including direct injection two-stroke engines and four-stroke engines, will decrease the amount of unburned fuel that escapes with PWC exhaust and will result in decreases in emissions (VanMouwerik and Hagemann, 1999). As a result of

EPA's 1996 rule requiring cleaner running SI marine engines,[3] a 50 percent reduction of current HC emissions from these engines is expected by 2020, and a 75 percent reduction in HC emissions is expected by 2025 (*Federal Register*, 1996).

Baseline Water Quality Conditions at CURE

In 1999, CURE conducted limited water and sediment sampling for BTEX, MTBE, and PAHs. The levels in the samples collected are low, and the constituents do not appear to pose significant risks to human health and aquatic life when compared to levels of concern found in the current literature when researched by NPS. Because PWC are currently banned from CURE, they have no impact on water quality.

Potential Impact of PWC Use on Water Quality Under the Proposed Alternatives

Alternative A: Reinstate PWC Use as Previously Managed Under a Special Regulation. Historically the impact of PWC use on water quality at CURE was assumed to be very limited because of the low number of PWC used at CURE. As described in the CURE EA, reinstating PWC use would have negligible to minor adverse effects based on impacts from benzo(a)pyrene, naphthalene, and benzene, based on human health benchmarks; modeling results indicate that pollutant loads would be well below ecotoxicological benchmarks. On a cumulative basis, impacts from benzo(a)pyrene, naphthalene, and benzene would be minor to moderate based on human health benchmarks and EPA and State of Colorado water quality criteria. NPS concludes that Alternative A would not result in an impairment of water quality.

Alternative B: Reinstate PWC Use as Previously Managed Under a Special Regulation, but with Additional Management Prescriptions. As described in the CURE EA, reinstating PWC use with additional management restrictions would have the same impacts, both PWC specific and cumulatively, as Alternative A.

[3] In 1996, EPA promulgated a rule to control exhaust emissions from new SI marine engines, including outboards and PWC. Emission controls provide for increasingly stricter standards beginning in model year 1998, with all PWC manufactured after 2006 required to be EPA emissions compliant (i.e., to reduce HC emissions by 75 percent from unregulated levels) (*Federal Register*, 1996).

Alternative C: No-Action Alternative (Continue PWC Ban). No impacts to water quality from PWC would occur within CURE if the ban continued.

2.5.2 Air Quality

Air quality and visibility can be affected by emissions from two-stroke engines such as PWC motors. Emissions from PWC in national parks are one of many potential (albeit, relatively small) sources of air quality and visibility impairments.

Recreational marine engines, including PWC and outboard motors, contribute approximately 30 percent of national nonroad engine emissions and are the second largest source of nonroad engine HC emissions nationally (*Federal Register*, 1996). According to the results of a 1990 inventory of emissions in California, watercraft engines were estimated to account for 141 tons of smog-forming reactive organic gases (ROG) 1,063 tons of carbon monoxide (CO), and 31 tons of nitrogen oxides (NO_x) emitted per day (Kado et al., 2000). A study comparing emissions from conventional and direct-injected two-stroke engines with four-stroke engines found that the new four-stroke engine has considerably lower emissions of PM, PAHs, and substances with genotoxic activity (Kado et al., 2000). Based on a comparison with a typical 90-horsepower engine, it is estimated the ban of conventional two-stroke engines would result in a four-fold decrease in smog-forming pollution per engine (VanMouwerik and Hagemann, 1999).

Up to one-third of the fuel delivered to conventional two-stroke engines goes unburned and is discharged as gaseous HCs.

Although PWC engine exhaust is usually routed below the waterline, a portion of the exhaust gas is released to the air and may affect air quality. Up to one-third of the fuel delivered to conventional two-stroke engines goes unburned and is discharged as gaseous HCs; the lubricating oil is used once and is expelled as part of the exhaust; and the combustion process results in emissions of air pollutants such as BTEX, MTBE, PAHs, NO_x, PM, and CO (Kado et al., 2000). PWC also contribute to the formation of ozone (O_3) in the atmosphere, which is formed when HCs react with NO_x in the presence of sunlight (EPA, 1993). (See Section 2.5.1 for further discussion of burned and unburned constituents of PWC emissions).

Several compounds in PWC exhaust are known to adversely affect both human and plant life. They may adversely affect park visitor and employee health, as well as sensitive park resources. O_3 causes respiratory problems in humans, including coughing, airway irritation, and chest pain during inhalation. O_3 is also toxic to sensitive species of vegetation. It causes visible foliar injury, decreases plant growth, and increases plant susceptibility to insects and disease (EPA, 1993).

CO can interfere with the oxygen-carrying capacity of blood, resulting in lower delivery of oxygen to tissues. NO_x and PM emissions associated with PWC use can also degrade visibility. Adverse health effects have been associated with airborne PM, especially less than 10 μm aerodynamic diameter (PM10) (Kado et al., 2000). NO_x also contributes to acid deposition effects on plants, water, and soil.

Baseline Air Quality Conditions at CURE

CURE is designated as a Federal Class II air quality area, a designation under the Clean Air Act that allows only moderate amounts of degradation of the existing air quality condition (NPS, 1995). Air quality is generally good. Air quality monitoring data have not been collected to determine the effects of combustion engine use in the park. However, the potential need for such a program has been addressed in CURE's General Management Plan (NPS, 1995). Air quality sampling in Gunnison, Colorado, was discontinued in 1981 because of consistently low to moderate particulate levels (Burns, 2000). Because PWC are currently banned at CURE, they have no impact on air quality.

Potential Impact of PWC Use on Air Quality Under the Proposed Alternatives

Alternative A: Reinstate PWC Use as Previously Managed Under a Special Regulation. NPS anticipates that air quality and air quality-related values would not be impaired under Alternative A. Historically the impact of PWC use on air quality at CURE was assumed to be very limited because of the low number of PWC used at CURE. As described in the CURE EA, reinstating PWC use would have negligible adverse impacts on human-health-related air quality from CO, HC, PM10, and NO_x. Risk from PAH would be

negligible. Minor adverse impacts to air quality-related values would be expected.

Alternative B: Reinstate PWC Use as Previously Managed Under a Special Regulation, but with Additional Management Prescriptions. As described in the CURE EA, reinstating PWC use with additional management restrictions would have the same impacts, both PWC specific and cumulatively, as Alternative A.

Alternative C: No-Action Alternative (Continue PWC Ban). No impacts to air quality from PWC would occur within CURE if the ban continued.

2.5.3 Soundscape

Natural sounds generally include the naturally occurring sounds of wind in the trees, calling birds, and the quiet associated with still nights. "Noise" is defined as unwanted sound. Sounds are described as noise if they interfere with an activity or disturb the person hearing them.

PWC emit up to 105 dB per unit at 82 feet, which may disturb park users (visitors and residents). NPS has established a noise limit of 82 dB at 82 feet. Noise from PWC may be more disturbing than noise from a constant source at 90 dB because of rapid changes in acceleration and direction of noise (EPA, 1974) and their ability to be driven in shallow water close to the shoreline. However, the newer, compliant models of PWC may be up to 50 to 70 percent quieter than the older models (PWIA, 2002a).

Baseline Soundscape Conditions at CURE

One aspect of experiencing CURE's resources is the ability to hear the sounds associated with its natural resources, often referred to as "natural sounds" or "natural quiet." Natural sounds generally include the naturally occurring sounds of wind in the trees, calling birds, and the quiet associated with still nights. "Noise" is defined as unwanted sound. Sounds are described as noise if they interfere with an activity or disturb the person hearing them.

Typical sounds at CURE include waves, wind in trees, visitors talking, road noise from vehicles in the recreation area and on Highway 50 and Highway 149, and motorboats on the reservoir. High-use areas, such as around boat launches, have higher ambient noise levels, particularly from boats launching and landing. Because PWC are banned at CURE, they have no impact on the soundscape.

Potential Impact of PWC Use on Soundscape Under the Proposed Alternatives

Alternative A: Reinstate PWC Use as Previously Managed Under a Special Regulation. NPS anticipates that the soundscape would not be impaired under Alternative A. As described in the CURE EA, reinstating PWC use would have minor to moderate adverse impacts at most locations on Blue Mesa Reservoir and the immediate surrounding area.

Alternative B: Reinstate PWC Use as Previously Managed Under a Special Regulation, but with Additional Management Prescriptions. As described in the CURE EA, reinstating PWC use with additional management restrictions would generally have the same impacts, both PWC specific and cumulatively, as Alternative A, with the exception of some beneficial impacts relative to Alternative A from additional speed and wake restrictions and creation of buffer zones.

Alternative C: No-Action Alternative (Continue PWC Ban). No impacts to the natural soundscape from PWC would occur within CURE if the ban continued.

2.5.4 Wildlife and Wildlife Habitat

PWC may affect wildlife by interrupting normal activities, inducing alarm or flight responses, causing animals to avoid habitat, and potentially affecting reproductive success.

PWC may affect wildlife by interrupting normal activities, inducing alarm or flight responses, causing animals to avoid habitat, and potentially affecting reproductive success. These effects are thought to be caused by a combination of PWC speed, noise, and ability to access sensitive areas, especially in shallow water (WDNR, 2000). PWC potentially can access sensitive shorelines and disturb riparian habitats critical to wildlife. When run in very shallow water, PWC can disturb the substrate, including aquatic plants and benthic invertebrates. At certain times of year, PWC may also affect fish breeding and nursery areas. Furthermore, water quality degradation caused by PWC can affect migratory avian species in the area.

Waterfowl and nesting birds may be particularly sensitive to PWC because of their noise, speed, and unique ability to access shallow water. This may force nesting birds to abandon eggs during crucial embryo development stages, keep adults away from nestlings, thereby preventing them from defending the nest against predators, and flush waterfowl from habitat, causing stress and associated

behavior changes (WDNR, 2000; Burger, 1998; Rodgers and Smith,1997).

Baseline Wildlife and Wildlife Habitat Conditions at CURE

Habitat along the reservoir shoreline is dominated by high desert sagebrush communities consisting of grasses, big sagebrush, rabbitbrush, and Gambel oak.

Habitat along the reservoir shoreline is dominated by high desert sagebrush communities consisting of grasses, big sagebrush, rabbitbrush, and Gambel oak. Intermittent pockets of Douglas fir, quaking aspen, and spruce are found primarily in the narrow canyons formed by some of the larger tributaries to the reservoir. The associated vegetational ecosystems provide habitat for a variety of wildlife, including, mule deer, bighorn sheep, mountain lion, elk, bald eagle, golden eagle, gunnison sage grouse, gray jay, Steller's jay, great blue heron, and black-billed magpie. A variety of small mammals are also present in CURE, including porcupines, weasels, skunks, and golden mantel ground squirrels. Bald eagles (federally listed as a threatened species) roost in the vicinity of Blue Mesa Reservoir and use the open waters of the reservoir and nearby tributaries to forage. Because PWC are currently banned at CURE, they have no impact on wildlife or wildlife habitat.

Potential Impact of PWC Use on Wildlife Habitat Under the Proposed Alternatives

Alternative A: Reinstate PWC Use as Previously Managed Under a Special Regulation. NPS anticipates that wildlife and wildlife habitat would not be impaired under Alternative A. As described in the CURE EA, reinstating PWC use would have negligible adverse impacts to fish and negligible to minor impacts to waterfowl and other wildlife. NPS reports that there would be no perceptible changes in wildlife populations or their habitat community structure (NPS, 2003). Cumulative adverse impacts to wildlife and wildlife habitat would be minor. All impacts would be temporary and short term.

Alternative B: Reinstate PWC Use as Previously Managed Under a Special Regulation, but with Additional Management Prescriptions. As described in the CURE EA, reinstating PWC use with additional management restrictions would generally have the same impacts, both PWC specific and cumulatively, as Alternative A, with the exception of slightly reduced impacts from wake restrictions.

Alternative C: No-Action Alternative (Continue PWC Ban). No impacts to wildlife or wildlife habitat from PWC would occur within CURE if the ban continued.

2.5.5 Threatened, Endangered, and Special-Concern Species

PWC may affect threatened, endangered, and special species of concern in the same manner they affect wildlife such as by disrupting or degrading the quality of habitat, interrupting normal activities, inducing alarm or flight responses, causing animals to avoid habitat, and potentially affecting reproductive success.

Baseline Conditions of Threatened, Endangered, and Special-Concern Species at CURE

The Colorado River cutthroat trout (state species of concern) is found in the Gunnison River below Crystal Reservoir. These trout are also found in two reservoirs below the Aspinall Unit and may occur in Black Canyon but not in the Blue Mesa Reservoir where PWC are permitted.

The sage grouse, a federal candidate species, nests close to the water at the Stevens Creek campground in CURE. The grouse's breeding season does not coincide with the PWC use season. PWC could disturb nesting birds, but NPS staff have not observed PWC disturbances to the species. The birds live in an area disturbed by automobiles and walking campers.

The great blue heron, a state species of concern, is found upstream in the Gunnison River and is located within an area already banned to motorized watercraft. The species could only be affected if visitors engage in illegal PWC use.

Bald eagles are found in CURE but do not nest around the reservoir during the months when PWC are in use. Bald eagles may use the lake for foraging at some times during the year. A potential golden eagle nest was located in Lake Fork Arm. NPS staff have not observed PWC disturbances to either species.

There are no listed shoreline plant species. There are two astragalis species, both species of concern, that occur in dry upland areas that could be accessed by PWC users on the south shore around Middle Bridge. These areas are also accessible by other means.

Because PWC are currently banned at CURE, they have no impact on protected wildlife species or habitat.

Potential Impact of PWC Use on Threatened and Endangered Species Under the Proposed Alternatives

Alternative A: Reinstate PWC Use as Previously Managed Under a Special Regulation. NPS anticipates that protected wildlife species would not be impaired under Alternative A. As described in the CURE EA, reinstating PWC use may affect, but is not likely to adversely affect, federal- or state-listed species. All park sensitive species are unlikely to be affected in the short or long term. On a cumulative basis, reinstating PWC use is not likely to adversely affect listed species because of a lack of species occurrences and access to species or their habitats.

Alternative B: Reinstate PWC Use as Previously Managed Under a Special Regulation, but with Additional Management Prescriptions. As described in the CURE EA, reinstating PWC use with additional management restrictions would generally have the same impacts, both PWC specific and cumulatively, as Alternative A, with the exception of beneficial impacts to some species from buffer zones and speed restrictions.

Alternative C: No-Action Alternative (Continue PWC Ban). No impacts to protected wildlife species from PWC would occur within CURE if the ban continued.

2.5.6 Shorelines and Shoreline Vegetation

PWC use may adversely affect shoreline habitat, including the shoreline, shoreline vegetation and submerged aquatic vegetation (SAV) beds. Shoreline and shoreline vegetation provide critical habitat for the juvenile stages of fish, as well as aquatic invertebrates, shellfish, waterfowl, and other fish life stages. SAV beds are critical to aquatic organisms because they reduce wave action, support nursery fish, provide protection from predators, stabilize sediment, and provide food for many species.

PWC can access areas where most other watercraft cannot go because of their shallow draft and thus may affect shoreline and shoreline vegetation. In addition, PWC may land on the shoreline, allowing visitors to access and disturb areas where sensitive plant

species exist. In addition, wakes created by PWC may cause erosion. Turbulence from boat propellers near the shoreline can also erode the shoreline by destabilizing the bottom (WDNR, 2000).

PWC use can affect SAV by increasing turbidity, which may result in decreased sunlight available for SAV, limit vegetation growth, and ultimately reduce water quality. PWC use in shallow water supporting SAV may reduce its value as important habitat for animals by redistributing the plants and organisms that use these grasses for habitat.

Baseline Condition of Shorelines and Shoreline Vegetation at CURE

Blue Mesa Reservoir is a deepwater lake and does not have many areas of shallow water or shoreline vegetation. When the reservoir is at full pool, wave action caused by watercraft activity could affect shoreline vegetation. However, full pool conditions occur infrequently. Furthermore, gusty winds common in CURE create stronger and more frequent wave action, and thus more erosion, than PWC use. Because PWC are currently banned at CURE, they have no impact on shorelines or shoreline vegetation. When considering potential impacts on shoreline vegetation, it is important to note that there are no sensitive shoreline plant species.

Potential Impact of PWC Use on Shoreline and Shoreline Vegetation Under the Proposed Alternatives

Alternative A: Reinstate PWC Use as Previously Managed Under a Special Regulation. NPS anticipates shorelines and shoreline vegetation would not be impaired under Alternative A. As described in the CURE EA, reinstating PWC use would have negligible adverse effects over the long and short term because vegetation on the shoreline is generally lacking, and areas where vegetation may occur would be protected by wake restrictions. On a cumulative basis, negligible to minor adverse effects would be expected in the short and long terms as a result of wind-related erosion, wave action, and other visitor activities such as boating.

Alternative B: Reinstate PWC Use as Previously Managed Under a Special Regulation, but with Additional Management Prescriptions. As described in the CURE EA, reinstating PWC use with additional

management restrictions would have beneficial impacts over the short and long terms as a result of the shoreline buffer from both a PWC-specific and cumulative impact.

Alternative C: No-Action Alternative (Continue PWC Ban). No impacts to shorelines and shoreline vegetation from PWC would occur within CURE if the ban continued.

2.5.7 Cultural Resources

Baseline Condition of Cultural Resources at CURE

Numerous prehistoric archeological sites surround Blue Mesa Reservoir and a National Register Archeological District encompasses the entire eastern one-third of the reservoir and surrounding shoreline. CURE also contains dinosaur, ancient ox, lion, cheetah, and termite burrows fossils and possible crocodile fossils.

Wave action produced by PWC could increase erosion rates at cultural resource sites. However, because PWC are currently banned at CURE, they have no impact on cultural resources.

Potential Impact of PWC Use on Cultural Resources Under the Proposed Alternatives

Alternative A: Reinstate PWC Use as Previously Managed Under a Special Regulation. NPS anticipates listed or potentially listed archaeological sites would not be impaired under Alternative A. There are no documented incidents of impacts to cultural resources from PWC use prior to the ban. Historical PWC impacts to cultural resource sites are negligible; strong wind action and other watercraft create more severe wave action and off-road vehicles can drive along the waterline and affect resources. As described in the CURE EA, reinstating PWC use would have minor adverse effects on listed or potentially listed archaeological sites from possible illegal collection and vandalism. On a cumulative basis, minor to major adverse effects would be expected as a result of the number of visitors and the potential for illegal collection or destruction.

Alternative B: Reinstate PWC Use as Previously Managed Under a Special Regulation, but with Additional Management Prescriptions. As described in the CURE EA, reinstating PWC use would have

minor adverse effects on listed or potentially listed archaeological sites from possible illegal collection and vandalism. Also, some areas would experience a beneficial impact from reduced erosion based on speed zones and speed restrictions. On a cumulative basis, minor to major adverse effects would be expected because of the number of visitors and the potential for illegal collection or destruction.

Alternative C: No-Action Alternative (Continue PWC Ban). No impacts on listed or potentially listed archaeological sites from PWC would occur within CURE if the ban continued.

2.6 ECONOMIC ACTIVITY IN THE SURROUNDING COMMUNITIES

The closest towns to CURE are Gunnison, Colorado, located at the eastern end of Blue Mesa Reservoir, and Montrose, Colorado, located approximately 40 miles west of CURE. The economy of Gunnison is diverse, with Western State College, medical facilities, recreation, and ranching making up a large percentage of the economy. Montrose depends on retail, service, and manufacturing industries for most of its economic base. Tourism is a major industry for the region, with visitors coming year-round to enjoy activities such as skiing, rafting, fishing, kayaking, camping hiking, and sightseeing.

One PWC rental concession is located on Blue Mesa Reservoir. One business that sells PWC and one that services PWC were identified in Montrose. A business that sells PWC and one that services PWC were identified in Gunnison, and two sales shops with revenues related to CURE were identified in Grand Junction. The estimated impacts to these businesses from reinstating PWC use are discussed in Sections 3, 4, and 5 of this report.

3 Economic Impact Analysis of Reinstating PWC Use in Curecanti National Recreation Area

Reinstating PWC use in CURE may affect the local economy in several ways, including changes in park visitation, sales and profits of local businesses, local employment, and local and state sales tax revenue. Generally, allowing PWC use in the park is expected to increase economic activity in the areas surrounding the park. However, the incremental impacts under Alternatives A and B are expected to be small relative to the size of the local economy.

Historically the percentage of total visitors to CURE that used PWC has been small. Prior to the ban, it is estimated that less than 0.5 percent of visitors used PWC in the park. Because PWC use was not necessarily their primary reason for visiting CURE, many former PWC users are likely to continue visiting the park under the ban. However, those park visitors who had previously used PWC in CURE are negatively affected by the current ban on PWC use in CURE. These visitors would also potentially be positively affected by any change in PWC regulations in CURE that reinstated PWC use in the park. Not only are PWC users potentially affected by any change in PWC regulations, but businesses, including PWC sales and rental shops, restaurants, and other establishments that provide services to those visitors may be affected as well.

A variety of economic analyses can be conducted to provide valuable information for policy makers trying to understand the effects of alternative policies. The type of analysis that is most appropriate for examining a particular policy or action depends on the decision under consideration. In the context of examining the impacts of regulation, two of the most important types of economic analysis are economic impact analysis and benefit-cost analysis. These types of analyses are often confused because they both

estimate the economic "benefits" associated with a particular policy. However, an economic impact analysis typically examines the effect of a change in policy on the economy of a particular region, while a benefit-cost analysis focuses on the change in economic efficiency resulting from a change in policy. Economic impact analyses trace the flows of spending associated with the affected industries to identify changes in sales, income, jobs, and tax revenues resulting from a policy action. Benefit-cost analysis, on the other hand, focuses primarily on changes in social welfare. Unlike economic impact analysis studies, benefit-cost analysis includes both market and nonmarket values (Stynes, 2000).

Reinstating PWC use in CURE is likely to have a positive economic impact on the surrounding area. The primary economic impacts associated with the PWC management alternatives are the potential increases in sales, profits, and employment of PWC rental and sales establishments, hotels, restaurants, and other businesses in the counties surrounding the park (Gunnison County and Montrose County in Colorado), relative to baseline conditions. The incremental impact of each alternative depends in large part on the way that affected individuals and firms responded to the ban on PWC use in CURE.[1] To the extent that local businesses that relied on PWC users prior to the ban are able to provide substitute products and services, they may be able to reduce the negative impacts on their profits. In addition, although it is expected that PWC users would decrease their overall visitation to the park because of the ban, they will not necessarily stop visiting the area altogether, especially if PWC use was not their primary activity. It is also possible that visitation to CURE by non-PWC users has increased under the ban if the absence of PWC users makes park visitation more enjoyable for this group of people, although NPS is unable to quantify this impact because of a lack of data. The more that producers and consumers are able to make adjustments to mitigate the negative impacts of the ban, and the more that non-

[1] Because PWC were not banned in CURE until November 2002, but the most recent data available were collected in 2001; no data regarding changes in PWC visitation or business revenues in response to the ban are available.

PWC users increase their visitation under the ban, the smaller the incremental positive impacts of reinstating PWC use in CURE.[2]

Economic impact analyses tend to overstate the impacts associated with rules such as the management alternatives for PWC use in CURE because they do not account for behavioral changes that may mitigate impacts. However, these analyses are still very important to policy makers because they provide an estimate of the impact on the local area most directly affected by the regulation. In addition to the total impacts associated with a regulatory action, the distribution of those impacts is important. Because benefit-cost and economic impact analyses have different emphases and different final results, but both provide useful information for measuring the impact of different PWC management alternatives, both types of analyses are presented in this report. This section describes an economic impact analysis of the proposed alternatives, while Section 4 presents a benefit-cost analysis.

The majority of the economic impacts are expected to be concentrated in the counties surrounding the park (Gunnison County and Montrose County in Colorado). Thus, projected changes in economic activity are compared to the size of the county economies to place the impacts in perspective.

3.1 SCENARIOS EXAMINED IN THIS REPORT

NPS estimates that about 2,475 visitors used PWC during 2001, accounting for only about 0.28 percent of annual visitation.

As described in Section 2.2, PWC users historically have accounted for a small fraction of total visitation to CURE. NPS estimates that approximately 2,475 visitors used PWC during 2001, accounting for only about 0.28 percent of annual visitation to CURE. Baseline visitation (i.e., with PWC banned from CURE) for non-PWC users was projected through 2012 based on average annual visitation by non-PWC users over a 5-year period, 1997 to 2001, as the starting point. Baseline non-PWC user visitation was then assumed to increase at a rate equal to the projected average annual percentage change in population for the counties surrounding CURE (NPS, 2003). Although there would be no PWC use in CURE in 2003–2012 under baseline conditions, it is likely that some former PWC

[2]A decrease in expenditures for substitute activities in the CURE region relative to baseline conditions in response to allowing PWC use to resume would partially offset any positive regional impacts associated with Alternatives A, B, and C. There may also be reallocation of revenue among businesses.

users would continue to visit the CURE region to enjoy other recreational activities.

PWC users are expected to change their visitation to CURE in response to changes in management of PWC use in the park. Thus, NPS constructed scenarios for the regulatory alternatives based on the available information to estimate the magnitude of the resulting economic impacts. Under Alternatives A and B it is expected that visitation will increase relative to baseline projections, based on visitation in recent years prior to a ban on PWC use. Under Alternative C, it is expected that visitation will not change relative to baseline projections because PWC management would not change relative to current conditions.

It is assumed that people who continue to visit the CURE area will have the same spending patterns as baseline conditions, except that some of them will resume renting or purchasing PWC. It is possible that former PWC users would have continued to visit the park to engage in other summer recreational activities and would have increased expenditures on those activities, but because there is no information on the amount these users might spend, this potential spending increase is not included in the analysis. In addition, as mentioned above, non-PWC users may have increased their visitation in response to the ban on PWC. To the extent that visitation by non-PWC users has increased following the ban on PWC use, the number of non-PWC users visiting this area may decrease relative to baseline because potential increases in noise and pollution resulting from changes in PWC management in CURE could decrease their enjoyment of the area.[3] However, neither the potential increase in non-PWC visitation under baseline conditions nor the potential decrease in non-PWC visitation were included in the analysis because of uncertainties in quantifying changes in visitation for this group of people and the associated changes in expenditure.

To better develop the economic impact scenarios, NPS interviewed PWC sales and rental shop employees identified in the area, concerning the expected impacts on those businesses. At the time the interviews were conducted (prior to the ban), these

[3]This could result from an increase in the number of visitor-days for current non-PWC users and/or visitation by people who did not previously travel to the park.

establishments generally expressed some concern that any restriction in PWC use could cause a reduction in sales as a result of negative publicity. Some shops indicated that sales had already fallen due to concerns about future restrictions on PWC use in CURE. All of the firms interviewed predicted very significant declines in PWC-related revenues under a ban on PWC, with up to 100 percent of losses of PWC-related revenues. This expectation by local businesses that the ban would have relatively large negative impacts suggests that reinstating PWC use would have positive impacts. The predicted impacts for local businesses are discussed in more detail in Section 5.

Based on information collected from local businesses and CURE park staff, scenarios were developed for each of the proposed regulatory alternatives. The three primary scenarios that were analyzed for CURE are summarized in Table 3-1. NPS assumed that, in the absence of the ban, PWC use would have increased at a 2.0 percent annual rate based on local population projections and historic local trends in PWC and boat ownership (NPS, 2003).

It was assumed that PWC visitation and rental revenues would increase to 100 percent of pre-ban levels under Alternative A, increase to 95 percent of pre-ban levels under Alternative B, and remain unchanged under Alternative C.

For non-PWC users, visitation to the park was assumed to be increasing at an annual rate equal to the projected average annual population growth rate for the counties in Region 10 surrounding CURE (see Section 2.2.3). That growth rate was 2.0 percent. For baseline conditions, it was assumed that 80 percent of the visitors no longer using PWC in CURE as a result of the ban would continue to visit the local area for alternative recreation purposes.

It was assumed that PWC visitation and rental revenues would increase to 100 percent of pre-ban levels under Alternative A, increase to 95 percent of pre-ban levels under Alternative B, and remain unchanged under Alternative C. PWC sales are assumed to increase to 100 percent of pre-ban levels under Alternative A, to increase to 95 percent under Alternative B, and to remain at 0 percent under Alternative C. The large expected changes in revenue from PWC sales are attributable to the fact that most customers of the local shops historically used PWC in CURE and are expected to resume buying from these local shops if PWC use is reinstated in the park.

Table 3-1. Assumptions Used in Analyzing Economic Impacts of CURE Regulatory Alternatives

	Alternative A	Alternative B	Alternative C
Annual percentage change in the number of visitors using PWC in CURE that would have occurred in the absence of a ban[a]	2.0%	2.0%	NA
Baseline annual percentage change in non-PWC user visitation to CURE[a]	2.0%	2.0%	2.0%
Percentage of visitors who used PWC in CURE prior to the ban who are expected to continue visiting the park for other activities[b]	80%	80%	80%
Percentage of visitors using PWC in CURE prior to ban who will resume PWC use in CURE as a result of reinstatement[b]	100%	95%	NA
Percentage of visitors renting PWC for use in CURE prior to ban who will resume renting PWC for use in CURE as a result of reinstatement[b]	100%	95%	NA
Percentage of visitors purchasing PWC in the CURE region prior to ban that will resume purchasing PWC in the CURE region if PWC use is authorized[b]	100%	95%	NA

[a] National Park Service (NPS). 2003. *Curecanti National Recreation Areas Personal Watercraft Use Environmental Assessment.* Washington, DC: National Park Service.

[b] NPS estimates.

The scenarios outlined in Table 3-1 are used in Section 3.2 to provide estimates of potential economic impacts resulting from reinstating PWC use in CURE under Alternative A or B. The fewer former PWC users who would continue to visit CURE to engage in alternative activities under the ban, the larger the overall impact of reinstating PWC use, other things being equal. Thus, the overall economic impact of this regulation depends on the willingness of former PWC users who are prevented by the ban from using PWC in the park to continue visiting CURE to engage in alternative recreational activities.

3.2 ECONOMIC IMPACT OF PWC REINSTATEMENT ON LOCAL ECONOMIES

Generally, reinstating the use of PWC in CURE is expected to increase economic activity slightly in the areas surrounding the park.

The proposed regulations may affect the local economy in several ways, including changes in park visitation, sales and profits of local businesses, local employment, and local and state sales tax revenue. Generally, reinstating the use of PWC in CURE is expected to increase economic activity in the areas surrounding the park. The following sections describe the estimated economic impacts on the region where the majority of the effects from increased visitation to CURE will be felt.

3.2.1 Effect of Management Alternatives on CURE Visitation

Alternatives A and B are expected to lead to an increase in the number of visitor-days spent in CURE compared with the projected baseline, as shown in Table 3-2. This anticipated increase in the number of visitor-days is primarily due to the expectation that the majority of people who visited to use their PWC prior to the ban will now return to the park because PWC use has been reinstated. The actual increase in park visitation depends on several factors. Some people who previously used PWC in CURE may choose to continue visiting the park to enjoy alternative summer activities available within CURE, such as hiking, boating, and fishing. As mentioned earlier, visitation by non-PWC users may have increased in response to the PWC ban. Thus, if PWC are reinstated, visitation by non-PWC users is likely to decline to levels that would have occurred in the absence of the PWC ban because the reinstatement of PWC may create a less enjoyable outdoor experience for some members of this group. This decrease in visitation would partially offset the increase in PWC users. However, neither the potential increase in visitation by non-PWC users in response to the PWC ban nor the expected decrease in visitation by non-PWC users if PWC use is reinstated are quantified in this analysis because the extent to which non-PWC users would decrease visitation is unknown.

Table 3-2. Incremental CURE Visitation under Regulation Relative to Baseline Conditions[a]

	Alternative A			Alternative B			Alternative C[b]		
Year	Former PWC Users that Resume PWC Use[c]	Non-PWC Users[d]	Total Visitation	Former PWC Users that Resume PWC Use[c]	Non-PWC Users[d]	Total Visitation	Former PWC Users that Resume PWC Use[c]	Non-PWC Users[d]	Total Visitation
2003	2,861	–2,289	572	2,718	–2,289	429	—	—	—
2004	2,918	–2,289	629	2,772	–2,289	484	—	—	—
2005	2,977	–2,289	688	2,828	–2,289	539	—	—	—
2006	3,036	–2,289	747	2,884	–2,289	596	—	—	—
2007	3,097	–2,289	808	2,942	–2,289	653	—	—	—
2008	3,159	–2,289	870	3,001	–2,289	712	—	—	—
2009	3,222	–2,289	933	3,061	–2,289	772	—	—	—
2010	3,287	–2,289	998	3,122	–2,289	833	—	—	—
2011	3,352	–2,289	1,063	3,185	–2,289	896	—	—	—
2012	3,419	–2,289	1,130	3,248	–2,289	959	—	—	—

[a]NPS generated these estimates using the assumptions in Table 3-1.

[b]NPS assumed that there would be no change in visitation relative to baseline conditions under Alternative C because this alternative maintains the ban on PWC use in CURE.

[c]This column includes those visitors who use PWC in the park prior to implementation of a ban on PWC use in CURE and who would resume PWC use in the park if it were authorized under Alternative A or B. It includes both former PWC users who were assumed to visit the park for other activities during the ban (who are recategorized from non-PWC users to PWC users in this table) and former PWC users who were assumed to stop visiting the park if they are unable to use their PWC (their return to visiting the park leads to a net increase in visitation relative to baseline for Alternatives A and B).

[d]These are the former PWC users who were assumed to continue to visit the park to engage in alternative activities under baseline conditions. If PWC use is authorized, these visitors are expected to resume using PWC in the park and are counted as PWC users rather than non-PWC users in the table.

3.2.2 Impact of Management Alternatives on Local Business Output

As a result of the incremental increase in visitation to the CURE area expected under Alternatives A and B, there will be a corresponding increase in the value of local business output. The primary sectors affected by increases in summer visitation are the tourism sectors, including PWC sales and rental shops, restaurants, and retailers. As discussed in Appendix A, although the direct impact of an increase

in visitor spending is primarily felt in these sectors, many additional sectors of the economy will be affected to some extent through secondary impacts. NPS focuses on the impacts estimated for reinstating visitation in 2003, the first PWC use season that would be affected if PWC use is reinstated. Impacts in subsequent years will be very similar and the impact in all years is estimated to be small relative to the size of the local economy.

No data are available concerning the increase in the number of PWC rented, sold, and serviced annually that would result from reinstatement in CURE. Thus, NPS used information from local businesses on their baseline revenues and the projected increases in PWC sales, rentals, and storage to project the total increase in revenue for these categories.

To estimate spending impacts, it is necessary to obtain spending information for use with this study's estimates on changes in visitation. No data are available concerning the reduction in the number of PWC rented, sold, serviced, and stored annually that would result from restrictions in CURE. Thus, NPS used information from local businesses on their baseline revenues and the projected reductions in PWC sales, rentals, and storage shown in Table 3-1 to project the total reduction in revenue for these categories.

For categories of tourism spending other than direct spending on PWC, spending profiles were used in conjunction with estimated changes in visitation to determine the total change in park-related expenditures. The Money Generation Model (MGM2) is a simple input-output (I-O) model that NPS often uses to estimate local economic impacts associated with national park visitation, and it provides generic spending profiles for national parks (see Appendix A and the MGM2 website <http://www.msu.edu/user/stynes/npsmgm/> for more information about economic impact analysis using I-O models).

Based on information collected from CURE staff, most visits to the park are day trips. NPS assumes that about 75 percent of visitors are local day users. The remaining 25 percent of visitors are split evenly between nonlocal day users and visitors who stay in a motel within the park, a motel outside the park, a campground within the park, or a campground outside the park. Table 3-3 provides the spending information available for both local and nonlocal visitors on day trips to show the range of spending values estimated. Only categories with positive average expenditures for these categories of visitors are included in the table. For this analysis, the medium[4]

[4]MGM2 provides spending estimates that they classify as low, medium, and high expenditures.

Table 3-3. Generic Spending Profiles for Visitors on Day Trips to National Parks (2001$)[a]

	Spending per Party		
	Low	**Medium**	**High**
Local Day User			
Restaurants and bars	8.64	12.35	16.05
Groceries/take-out	4.33	6.19	8.04
Gas and oil	3.37	4.82	6.27
Other vehicle expenses	0.36	0.52	0.67
Admissions and fees	2.94	4.21	5.47
Clothing	0.69	0.98	1.28
Sporting goods	0.70	1.00	1.29
Souvenirs and other expenses	4.68	6.68	8.69
Total	**$25.72**	**$36.74**	**$47.76**
Nonlocal Day User			
Restaurants and bars	11.52	16.46	21.40
Groceries/take-out	4.33	6.19	8.04
Gas and oil	6.75	9.64	12.53
Other vehicle expenses	0.54	0.78	1.01
Local transportation	0.18	0.26	0.33
Admissions and fees	5.15	7.36	9.57
Clothing	1.38	1.96	2.55
Sporting goods	0.70	1.00	1.29
Souvenirs and other expenses	6.48	9.26	12.03
Total	**$37.03**	**$52.90**	**$68.77**
Motel Inside the Park			
Motel, hotel, cabin, or B&B	66.89	95.56	124.33
Restaurants and bars	24.49	34.99	45.48
Groceries/take-out	4.33	6.19	8.04
Gas and oil	6.07	8.68	11.28
Other vehicle expenses	1.09	1.55	2.02
Local transportation	0.36	0.51	0.67
Admissions and fees	8.10	11.57	15.04
Clothing	2.75	3.93	5.11
Sporting goods	0.70	1.00	1.29
Souvenirs and other expenses	7.92	11.31	14.71
Total	**$122.70**	**$175.28**	**$227.86**

(continued)

Table 3-3. Generic Spending Profiles for Visitors on Day Trips to National Parks (2001$)[a] (continued)

	Spending per Party		
	Low	**Medium**	**High**
Camping Inside the Park			
Camping fees	11.27	16.09	20.92
Restaurants and bars	7.20	10.29	13.38
Groceries/take-out	9.38	13.40	17.42
Gas and oil	7.42	10.61	13.79
Other vehicle expenses	0.54	0.78	1.01
Local transportation	0.18	0.26	0.33
Admissions and fees	4.42	6.31	8.20
Clothing	2.06	2.95	3.83
Sporting goods	0.70	1.00	1.29
Souvenirs and other expenses	4.32	6.17	8.02
Total	**$47.49**	**$67.85**	**$88.20**
Motel Outside the Park			
Motel, hotel, cabin, or B&B	56.33	80.47	104.61
Restaurants and bars	27.37	39.10	50.83
Groceries/take-out	7.22	10.31	13.40
Gas and oil	6.07	8.68	11.28
Other vehicle expenses	1.09	1.55	2.02
Local transportation	0.36	0.51	0.67
Admissions and fees	8.83	12.62	16.41
Clothing	4.13	5.89	7.66
Sporting goods	0.70	1.00	1.29
Souvenirs and other expenses	8.64	12.34	16.04
Total	**$120.73**	**$172.48**	**$224.22**
Camping Outside the Park			
Camping fees	15.49	22.13	28.77
Restaurants and bars	8.64	12.35	16.05
Groceries/take-out	6.49	9.28	12.06
Gas and oil	7.42	10.61	13.79
Other vehicle expenses	0.54	0.78	1.01
Local transportation	0.18	0.26	0.33
Admissions and fees	9.57	13.67	17.77
Clothing	4.13	5.89	7.66
Sporting goods	0.70	1.00	1.29
Souvenirs and other expenses	8.64	12.34	16.04
Total	**$61.81**	**$88.30**	**$114.79**

[a]These values are based on the average expenditures per party for visitors to national parks. However, the number of people per party assumed by MGM2 may differ between visitor segments.

Source: Money Generation Model—Version 2 (MGM2). 2002. <http://www.msu.edu/user/stynes/npsmgm/>. As obtained July 2002.

estimate was used for all of the spending categories analyzed. Because there is no spending category included that represents boat rentals, purchases, service, or storage, it was assumed that the spending estimates from MGM2 are in addition to the directly PWC-related expenditures described above.

The MGM2 model assumes different party sizes, average lengths of stay, and number of entries into the park for the various visitor groups based on data gathered from several national parks.[5] The spending profile estimates in Table 3-3 were used in conjunction with the estimates of visitation changes presented in Table 3-2 to calculate the direct impacts of each alternative on business revenues presented in Table 3-4.[6]

For Alternative A, PWC rental revenues are estimated to increase by $17,690 relative to the baseline estimate. PWC sales and service revenues are expected to increase by $410,200.[7] Under Alternative B, NPS estimates that PWC rental revenues would increase by $16,800 and PWC sales and service revenues by $382,860, relative to the baseline.[8] Alternative C is expected to have no incremental impact on business revenues because it maintains baseline conditions.

As shown in Table 3-4, the largest direct impact is on establishments offering PWC sales and/or service, which account for almost 94 percent of the estimated revenue increases resulting from allowing PWC to return to CURE. The increase in PWC sales and service revenues is followed by PWC rental revenues; restaurants and bars; souvenirs and other retail; groceries/take-out; gas and oil; admissions and fees; motel, hotel, cabin or B&B; clothing; sporting goods; camping fees; other vehicle expenses; and local transportation.

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[5]The model adjusts for multiple entries into the park to avoid counting expenditures for a single party more than once.

[6]Because MGM2 uses different assumptions for group size and multiple entries for each user category, it is not possible to use a constant party size and multiply the spending per party estimates presented in Table 3-4 by the expected changes in visitation in Table 3-3 to get the revenue impacts presented in Table 3-5.

[7]Assuming 50 percent of these revenues are made up by service and 50 percent by new machines, this would represent the purchase of approximately 28 new PWC at $7,800 each.

[8]Estimated impacts on PWC rentals, sales, and service were derived from interview data collected from local firms.

Table 3-4. First-Year Direct Impact of PWC Reinstatement on Business Revenues in CURE Region Relative to Baseline (2001$)[a,b]

	Alternative A	Alternative B	Alternative C
PWC rentals and other PWC revenues	$17,690	$16,800	$0
PWC sales/service	$410,200	$382,860	$0
Motel, hotel cabin or B&B[c]	$930	$880	$0
Camping fees[c]	$180	$170	$0
Restaurants and bars	$2,800	$2,660	$0
Groceries/take-out	$1,330	$1,260	$0
Gas and oil	$1,130	$1,070	$0
Other vehicle expenses	$120	$120	$0
Local transportation	$10	$10	$0
Admissions and fees	$1,030	$980	$0
Clothing	$280	$270	$0
Sporting goods	$210	$190	$0
Souvenirs and other retail	$1,470	$1,390	$0
Total	$437,380	$408,660	$0

[a]All impacts were rounded to the nearest $10. Columns may not sum to totals due to rounding.

[b]NPS generated these estimates using the MGM2 model (MGM2, 2002).

[c]Based on information provided by CURE staff, almost all visits to the park are day trips. Thus, NPS assumed that there were no visitors to the park staying overnight as part of a multiple day trip to the park.

Note that the estimated increases in revenue in Table 3-4 overstate the true direct gains to the region because part of the sales value in the groceries/take-out, gas and oil, clothing, sporting goods, and souvenirs/retail categories goes to individuals and firms outside of the region and thus cannot be considered a gain to the CURE region. Using these changes in revenues as inputs into MGM2, NPS estimated the total regional impacts on output. As discussed in Appendix A, only the gain of the retail markup in the retail sector can be included as an increase in regional output for the local area. This explains why the direct effect on the region estimated by MGM2 (reported in Table 3-5) is smaller than the change in revenues provided as input.

Table 3-5. First-Year Total Impacts on Value of Output for CURE Region (2001$)[a,b]

	Alternative A	Alternative B	Alternative C
Direct effect	$195,990	$181,880	$0
Total impact	$272,630	$252,970	$0

[a]All impacts were rounded to the nearest $10. Columns may not sum to totals due to rounding.

[b]NPS generated these estimates using the MGM2 model (MGM2, 2002).

The impacts of PWC regulation in CURE on regional output are estimated to be less than 0.03 percent of local personal income under Alternative A, the alternative with the largest positive impact.

In addition to the direct effect of the regulation on the regional economy, the indirect and induced effects (ripple effects on input suppliers and from changes in household income, respectively) are estimated (see Appendix A). The multipliers used for this analysis are those provided in MGM2 for a typical small metropolitan area. Table 3-5 also summarizes the total impacts on the value of output for businesses in the CURE region. In this case, the multiplier effects are moderate. The total impact is about 30 percent larger than the direct effect. The total impact estimated for the three alternatives varies from $0 to $272,630, depending on the PWC regulatory alternative. The level of personal income in Gunnison and Montrose Counties was about $1.04 billion in 2001 (BEA, 2002). Thus, the economic impact of PWC regulation in CURE on regional output is estimated to be less than 0. 03 percent of local personal income under Alternative A, the alternative with the largest positive impacts.[9]

3.2.3 Change in Value Added

Another measure of the impact on the local economy is the change in value added as a result of the regulation. Value added is the amount of dollar value contributed to a product at each stage of its production. It is calculated at each stage by subtracting the costs of intermediate goods from the value of the final good to avoid double-counting the value of intermediate goods. It will be a smaller value than output because it excludes the value of intermediate goods, whereas output measures do not exclude all intermediate goods. The output measure only excludes the cost of

[9]This is a conservative measure of the relative impact on the regional economy. For example, a portion of the estimated increase in regional output is being spent on inputs from outside the region. The estimated increase in regional personal income relative to baseline personal income is about 0.02 percent under Alternative A.

goods produced in other regions resold by wholesalers or retailers. To calculate these values for CURE, the MGM2 data for value added as a share of total output in each sector were applied to the estimated changes in local output presented in Table 3-5 to get the direct effect on value added by sector. The MGM2 multiplier for value added in each sector was then applied to estimate the total impact. Table 3-6 provides the total change in value added for the local region as a result of the proposed regulations.

Table 3-6. First-Year Total Impacts on Value Added for CURE Region (2001$)[a,b]

	Alternative A	Alternative B	Alternative C
Direct effect	$97,150	$90,150	$0
Total impact	$194,790	$180,990	$0

[a]All impacts were rounded to the nearest $10. Columns may not sum to totals due to rounding.

[b]NPS generated these estimates using the MGM2 model (MGM2, 2002).

3.2.4 Effect on Personal Income

Personal income is a portion of value added in which policy makers are commonly interested. It comprises employee compensation and proprietor income. Table 3-7 shows how labor income in the CURE region changes as a result of reinstating PWC use. This value is smaller than value added because it includes only a subset of the components of value added, but it is often useful to break value added down in this way to estimate the effect on regional personal income. Similar to value added, the direct effect of this component is calculated using the MGM2 data for personal income as a share of output in each sector. The total effect is then calculated by multiplying the direct effect by the personal income multiplier included in MGM2 for each sector.

3.2.5 Change in Employment

Another effect of the proposed regulations is to increase employment in the sectors affected by the rules. These changes are calculated by MGM2 based on ratios of sales to employment for the affected industries in the CURE area. As a result of the increase in sales anticipated under this regulation, companies will need additional employees. The estimated increase in employment

Table 3-7. First-Year Total Impacts on Personal Income for CURE Region (2001$)[a,b]

	Alternative A	Alternative B	Alternative C
Direct effect	$63,920	$59,320	$0
Total impact	$123,230	$114,540	$0

[a]All impacts were rounded to the nearest $10. Columns may not sum to totals due to rounding.

[b]NPS generated these estimates using the MGM2 model (MGM2, 2002).

ranges from 0 to 6.7 employees, depending on the management alternative. These values are calculated based on MGM2 data on the number of employees per million dollars of output in each industry. Estimated changes in the number of employees are therefore equal to the change in output times the number of employees required per unit of output. Table 3-8 summarizes the results of the employment analysis.

Table 3-8. First-Year Total Change in Employment for CURE Region (Number of Jobs)[a]

	Alternative A	Alternative B	Alternative C
Direct effect	5.5	5.1	0.0
Total impact	6.7	6.2	0.0

[a]NPS generated these estimates using the MGM2 model (MGM2, 2002).

3.2.6 Change in Tax Revenue

In addition to impacts on the local businesses operating near CURE, there is also an impact on the state and local governments. The state income tax rate for Colorado is 4.63 percent. The state sales tax rate is 2.9 percent. In addition, local governments have the option to charge approximately 1 percent sales tax in addition to the state tax. The counties surrounding CURE have different tax rates (Montrose and Gunnison Counties both have a 1.0 percent sales tax, but Montrose County has an additional 1.9 tax on lodging). To estimate the impacts, NPS assumed all local governments received funds from a 1 percent local option sales tax and that half of lodging expenditures would be subject to the 1.9 percent supplemental lodging tax. State income taxes from affected businesses are estimated to increase between $0 and $2,960 in the three scenarios analyzed, as presented in Table 3-9, based on estimated changes in

Table 3-9. First-Year Change in State and Local Sales Tax Revenue[a,b]

	Alternative A	Alternative B	Alternative C
State income tax	$2,960	$2,750	$0
State sales tax	$12,680	$11,800	$0
Local sales tax	$4,370	$4,070	$0

[a]All impacts were rounded to the nearest $10. Columns may not sum to totals due to rounding.

[b]NPS generated these estimates using the MGM2 model (MGM2, 2002).

business revenue. State sales tax receipts are predicted to increase by $0 to $12,680. Local sales taxes are estimated to increase by $0 to $4,370.

3.2.7 Summary

NPS estimates that the total impact on regional output is $272,630, $252,970, and $0, for Alternatives A, B, and C, respectively. These gains are very small compared to the size of the regional economy, even under Alternative A, the alternative with the largest impacts.

Several different measures of the economic impacts resulting from reinstating PWC use in CURE are presented in this section. Each measure provides slightly different information about the expected economic effects on the region. Income and value added are generally considered the best measures of economic impacts because sales and job estimates can be misleading. Sales or output measures include spending on inputs purchased outside the region, and job estimates are distorted by part-time and seasonal positions because the data available are on jobs, not on full-time equivalents. In addition, the wage rates across different jobs vary widely across industries (Stynes, 2000). Income and value-added measures both avoid these difficulties and concentrate on changes that affect only the CURE region.

In the analysis presented here, NPS estimates that the total impact of the proposed alternatives for regulating PWC use in CURE on regional output is $272,630, $252,970, and $0 for Alternatives A, B, and C, respectively, in the first year after rule implementation (see Table 3-5). These gains are small compared to the size of the regional economy, even under Alternative A (the alternative with the largest impacts). In 2000, total personal income in Gunnison and Montrose Counties, where CURE is located, was approximately $1.04 billion (Bureau of Economic Analysis, 2002). Thus, even if all revenues related to PWC use in CURE were to return to the regional economy, the impact would be very small (regional output would

increase by less than 0.03 percent of personal income), although some businesses and communities in the counties that rely heavily on PWC users may experience localized impacts.

3.2.8 Uncertainty

A number of factors will affect the regional economic impacts associated with the proposed alternatives. The 1996 EPA Marine Engine Rule, enacted by EPA in 1996, may have an impact on PWC use nationally and in CURE. As described in Section 2.2.4, this rule requires PWC (and other SI marine engine) manufacturers to phase in emissions reductions of 75 percent between the 1998 and 2006 model years (*Federal Register*, 1996). These emissions reductions are expected to increase the cost of producing PWC over time. The corresponding increase in market price of PWC may lead to a reduction in sales that would reduce PWC ownership and use relative to the projected levels. This would tend to reduce the incremental benefits and costs attributable to NPS regulations in future years. However, production cost increases due to these regulations are probably captured in the current baseline to some degree because the rule has already required some reduction in emissions.

NPS identified the following additional uncertainties:

Although NPS has provided its best estimate of the regional economic impacts associated with the proposed alternatives, numerous sources of uncertainty may influence the results.

- The projections of PWC use in the absence of the ban were based on an estimate of historic PWC use as a percentage of total visitation and the local trends in population and PWC and boat registrations. To the extent that PWC users accounted for an unusually small or large proportion of total visitation between 1997 and 2001, visitation by PWC users in the absence of the ban may be understated or overstated. In addition, the trends in local population and PWC ownership may not constitute a good proxy for the future annual change in visitation to CURE by PWC users. It may understate or overstate the actual change in CURE PWC use that would occur in future years under baseline conditions. The uncertainties associated with the baseline projections are discussed in further detail in Section 2.2.
- The proportion of PWC users who would have continued to visit the park under the ban on PWC use is unknown. As a result, the incremental increase in visitation resulting from reinstating PWC use may be higher or lower than calculated in this analysis.
- Non-PWC users may have increased visitation following the ban. To the extent that they would reduce their visitation relative to the baseline if PWC use were reinstated, the

positive impacts to local businesses of reinstating PWC use would be partially offset. Because insufficient information regarding this effect was available, this potential impact was not quantified in the analysis, which will tend to overstate the regional impacts.

- Generic spending patterns and multipliers from MGM2 were used to represent economic activity in the CURE area. To the extent that spending patterns of PWC users in CURE differ from the generic spending of local and nonlocal day users and/or the generic multipliers for a national park in a small metropolitan area differ from the multipliers for the CURE region, the impacts may be understated or overstated.
- In addition, the general uncertainties and caveats are associated with the use of I-O models. These factors are described in further detail in Appendix A.

4 Benefit-Cost Analysis of the Alternative Regulations

The purpose of benefit-cost analysis is to evaluate the social welfare implications of a proposed action—in this case the regulation of PWC use in national parks. The impacts of this action, both the benefits and costs, will ultimately be experienced as changes in well-being for households/individuals.

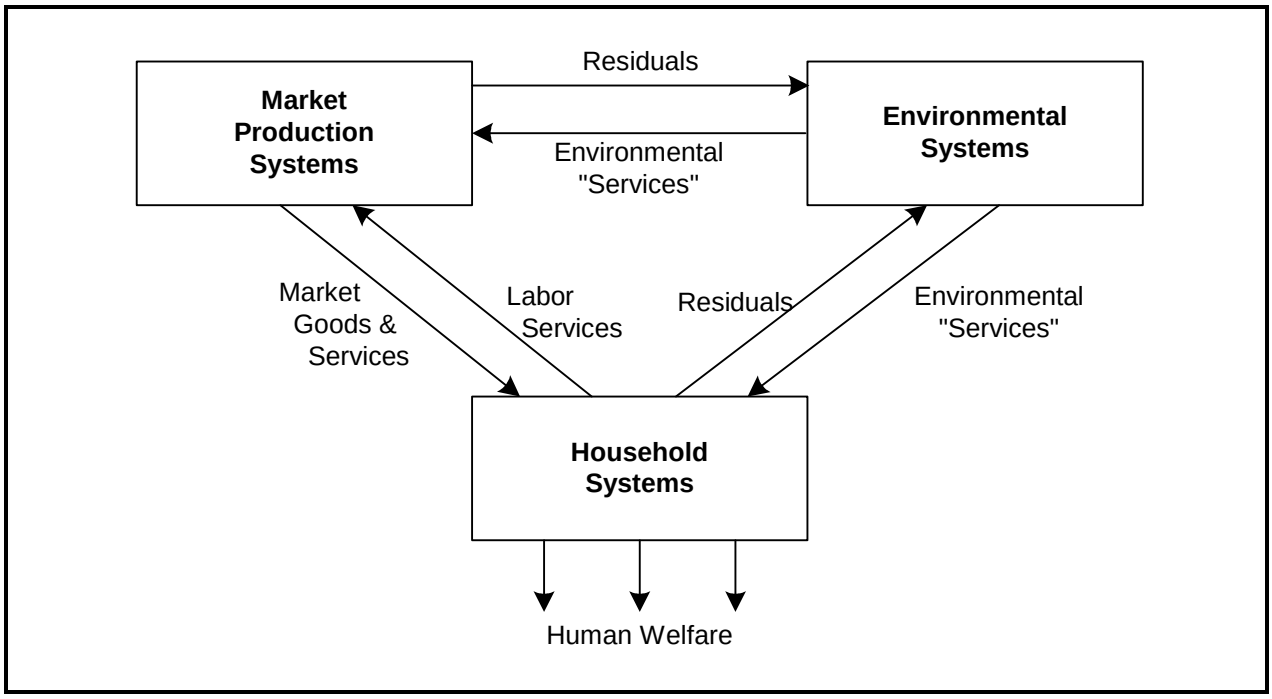
The purpose of benefit-cost analysis is to evaluate the social welfare implications of an action—in this case the management of PWC use in national parks. It examines whether the reallocation of society's resources resulting from the action promotes efficiency. That is, it assesses whether the action results in benefits (gains in social welfare) greater than the associated costs to society (losses in social welfare).

Section 4.1 provides a general outline of the approach to benefit-cost analysis and the possible benefits and costs of PWC regulations in national parks. Section 4.2 presents the analysis for CURE specifically.

4.1 CONCEPTUAL BASIS FOR BENEFIT-COST ANALYSIS OF PWC RESTRICTIONS IN NATIONAL PARKS

According to the conceptual underpinnings of benefit-cost analysis, all social welfare impacts ultimately accrue to individuals. This is represented in Figure 4-1, which depicts flows of goods, services, and residuals among three major systems: market production, household, and the environment. Because these systems are closely interconnected, actions taken to reduce releases of harmful residuals (e.g., chemicals or noise pollution) to the environment will potentially reverberate throughout all of these systems.

Figure 4-1. Interrelationship Among Market, Environmental, and Household Systems and Social Welfare



Nevertheless, the impacts of these actions, both the benefits and costs, will ultimately be experienced as changes in well-being for households/individuals. As a result, identifying and measuring benefits and costs must focus on these changes in well-being.

The conceptual framework depicted in Figure 4-1 therefore provides a basis for assessing the benefits and costs of PWC regulations in national parks. In these cases, the most direct impact will be on households that use PWC, whose recreational opportunities will be affected by the regulations. This will result in direct changes in welfare for these households. In addition, the resulting changes in the behavior of these households are likely to affect environmental systems and market systems. Effects on these systems will indirectly affect the welfare of other households. For example, the park environment will be improved or degraded, and this change will affect the "services" (primarily recreation-related) that the park provides to other households and individuals in society. Businesses that cater to non-PWC visitors may also be affected if the number of people visiting the park changes. On the other hand, the resulting changes in the market demand for PWC-related goods and services

will have impacts for those who own or work for establishments supplying these services.

These types of direct and indirect impacts are identified and evaluated as part of this benefit-cost analysis. Specifically, in Section 4.2 NPS estimates the incremental benefits and costs relative to the baseline.

In certain instances, welfare changes are directly the result of monetary gains or losses and can therefore be thought of as being equivalent to these gains or losses. In other instances, welfare changes are not directly associated with pecuniary gains or losses.

Estimating the value of benefits and costs also requires methods for expressing welfare changes in monetary terms. In certain instances, welfare changes are directly the result of monetary gains or losses and can therefore be thought of as being equivalent to these gains or losses. For example, welfare gains or losses to PWC sales shops due to changes in demand for their services can be reasonably measured as their resulting net change in income. In other instances, welfare changes are not directly associated with pecuniary gains or losses. Such "nonmarket" changes might, for example, include the welfare gains or losses from improved or degraded recreational opportunities in a park. In these cases a surrogate measure of gains or losses must be used; willingness to pay (WTP) is such a surrogate. Economists and other practitioners of benefit-cost analysis generally accept WTP as the conceptually correct measure for valuing changes in individuals' welfare. WTP represents the maximum amount of money that an individual would be willing to forgo to acquire a specified change. As such, it is the monetary equivalent of the welfare gain from the change.

Using this conceptual framework for identifying, measuring, and valuing changes in societal welfare, the remainder of this section and Appendix B provide a more detailed discussion of

- ➤ the types of benefits and costs associated with PWC restrictions in national parks and
- ➤ the approaches used in measuring these benefits and costs.

4.1.1 Social Costs of PWC Use

Use of PWC in national parks may be associated with a number of negative impacts on environmental resources and ecosystems. The extent to which adverse impacts will be realized is a function of several factors, including the level of use, the technology of the machines being used, and the extent to which users remain in designated areas. One result of any negative impacts that occur is that they impose welfare losses on individuals who value the parks'

Because PWC users do not have to pay the full social cost of using a PWC and instead only pay the lower, private cost, PWC use will be maintained at a higher level than socially optimal in the absence of regulation.

environmental systems. The negative impacts of PWC use on other people are also referred to as negative externalities. If PWC do generate negative externalities, then this represents a market failure. The private cost of using a PWC (the cost to the individual PWC user) will be lower than the social cost of PWC use (where the social cost of PWC use includes both the cost to the PWC user plus the costs to others that result from the negative externalities associated with PWC use). Because PWC users do not have to pay the full social cost of using a PWC and instead only pay the lower, private cost, PWC use will be maintained at a higher level than socially optimal in the absence of regulation.

The costs of allowing PWC in national parks can therefore be thought of and measured as the increase in these incremental losses to society. In addition, use of PWC can negatively affect society in ways that are not directly related to the environment; therefore, the incremental costs of PWC regulations must also include increases in these nonenvironmental losses.

Table 4-1 provides a broad classification of the types of environmental and nonenvironmental impacts associated with PWC use in national parks. In this section, this classification is used to more completely identify, categorize, and describe the full range of potential benefits associated with PWC restrictions in national parks in general. In Section 4.2.3, this framework is then used to specifically describe the costs that are expected to result from the management alternatives for CURE.

Table 4-1. Classification of Potential Negative Impacts from PWC Use in National Parks

Impact Categories	Examples of Impacts
Environmental impacts	
Aesthetic	Noise, visibility, odor
Human health	Through impacts to air and water quality
Ecosystems	Loss of or damage to habitat and wildlife
Nonenvironmental impacts	
Infrastructure	Costs of monitoring, maintenance, and law enforcement
Human safety	Accidents
Cultural, historical, and archeological	Physical damages

The value that people place on a particular recreational activity depends strongly on the availability of substitutes. In areas where there are numerous recreational activities available, the value of improving environmental conditions in one of those areas will tend to be smaller.

Environmental Costs of PWC Use

The use of PWC may have adverse impacts on air quality, natural resources (e.g., water quality, habitat), wildlife, and natural quiet. Figure 4-2 depicts the various categories of potential adverse effects to the environment through which PWC use in national parks can impose welfare losses on society.

- Typical (two-stroke) PWC release substantial amounts of noise and pollutants into the environment. Noise from PWC impairs the natural soundscape for park visitors and has the potential to negatively affect wildlife in the park. Emissions from PWC can also negatively affect park ecosystems, human health, and visitor experiences. The three primary reasons for the potential impacts due to release of pollutants are as follows:
  - ✓ up to one-third of the fuel delivered to the engine is expelled without being burned,
  - ✓ lubricating oil is mixed with fuel and thus is expelled as part of the exhaust, and
  - ✓ the combustion process results in high emissions of air and water pollutants.

Pollutants are directly released to air and water, causing contamination of air and water resources.

As shown in Figure 4-2, all of these impacts can, directly or indirectly, lead to losses in human welfare. Therefore, from a benefit-cost perspective, those who ultimately lose from actions to allow PWC will be individuals who value the quality of the park environment. Many of those that experience losses will be park visitors whose recreational experiences are disturbed. As a point of reference, Table 4-2 reports average consumer surplus values that have been estimated for common non-PWC-related summer recreation activities from a study by Rosenberger and Loomis (2000). These are the types of recreation values that may be diminished by the presence of PWC.

The value that people place on a particular recreational activity depends strongly on the availability of substitutes. In regions where numerous areas are available for recreational activities, the value of changing environmental conditions in one of those areas will tend to be smaller. The reason is that there are already many other areas where people can engage in the same activity. Unless there are unique characteristics that people value in the area where

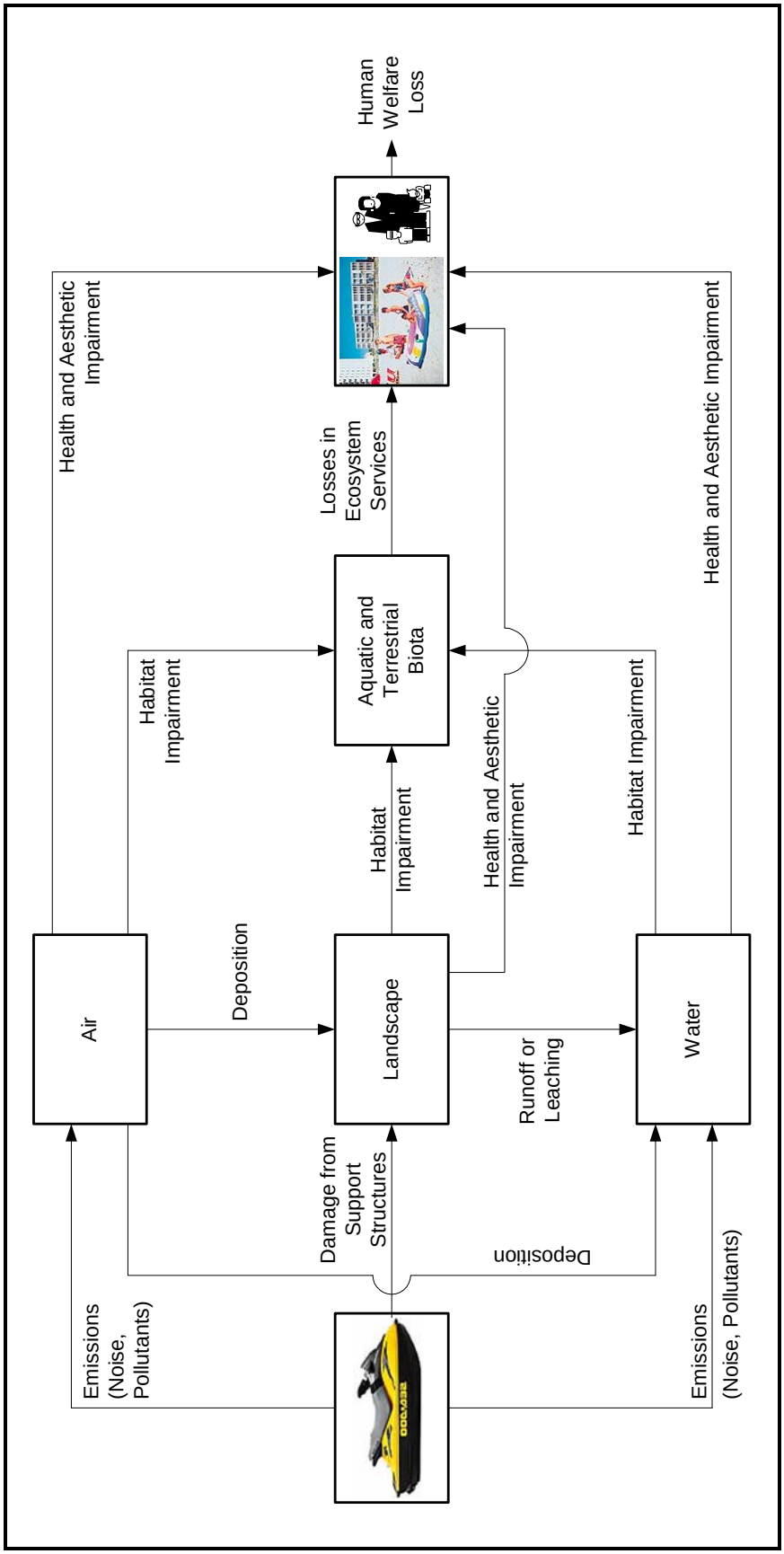


Figure 4-2. Routes of Environmental Damages and Human Welfare Losses from PWC Use in National Parks

Table 4-2. Summary of Average Recreation Values (2001$ per Person per Day) for Selected Activities by Region[a,b]

Activity	Study Location					U.S. Average
	Northeast	Southeast	Mountain	Pacific	National[c]	
Picnicking	59.46 (1)	40.10 (1)	39.10 (7)	79.62 (2)	16.89 (1)	45.78 (12)
Swimming	40.06 (5)	NA	NA	16.10 (1)	22.26 (1)	34.10 (7)
Hiking/backpacking	48.46 (2)	118.40 (2)	40.29 (3)	21.95 (6)	22.47 (1)	43.48 (14)
Fishing	34.06 (42)	29.87 (13)	45.75 (39)	39.96 (16)	40.12 (4)	38.62 (114)
Motor boating	56.46 (2)	NA	74.04 (2)	16.29 (1)	41.67 (1)	53.16 (6)

NA = Not available.

[a]All amounts were inflated using the consumer price index for recreation available from the U.S. Bureau of Labor Statistics (2002). Numbers in parentheses represent the number of observations (i.e., studies).

[b]These values were taken from multiple studies conducted between 1967 and 1998.

[c]Studies estimating nationwide values.

Source: Rosenberger, Randall, and John Loomis. 2000. "Using Meta-Analysis for Benefit Transfer: In-Sample Convergent Validity Tests of an Outdoor Recreation Database." *Water Resources Research* 36(4):1097-1107.

conditions will be improved or degraded, there will probably be relatively small benefits or costs as a result of the environmental change. On the other hand, in regions with few substitutes for the local national park that would potentially experience environmental damage as a result of the regulations, the losses to park users may be much greater.

Even individuals who are not park visitors (i.e., nonusers) can benefit from the knowledge that park resources are being protected and preserved. In other words, they may hold positive or negative "nonuse values" (i.e., a positive WTP) for protecting or degrading the park environment. These nonuse values can stem from the desire to ensure others' enjoyment (both current and future generations) or from a sense that these resources have some intrinsic value. Pearce and Moran [1994] review studies that have attempted to estimate nonuse values for the protection of unique species and ecosystems. The measurement of nonuse value remains controversial, and in this report NPS does not attempt to quantify the possible benefits or costs associated with nonuse values. Allowing PWC use in national parks can therefore result in losses to

both users and nonusers in a number of ways by degrading the parks' ecological resources.

Appendix B provides a detailed discussion of the nonenvironmental impacts in particular, and how these restrictions can affect public safety in national parks and the costs of operating and maintaining the infrastructure necessary to support and monitor PWC use.

4.1.2 Social Benefits of PWC Use

The primary benefits associated with allowing the use of PWC in national parks will accrue to

- PWC users, especially individuals who would otherwise not use PWC in the park as a direct result of the ban on PWC use, and
- providers of PWC-related services for park visitors.

After conducting an extensive review of the economics literature and consulting with the authors of existing studies, experts in recreation demand analysis at universities, and other experts, NPS was unable to locate a study that estimated the consumer surplus for a PWC trip.

Just as Section 4.1.1 described potential consumer surplus losses to other park visitors and the public associated with PWC use, the potential welfare gains to PWC users are measured in terms of consumer surplus. Regulations that restrict the use of PWC impose costs on PWC users. For instance, prohibiting PWC use in the park has resulted in a loss of the consumer surplus for former CURE PWC users. Allowing PWC use in CURE under Alternative B, which imposes restrictions such as limiting the areas of the park that are open to PWC, would increase the consumer surplus of PWC users relative to baseline. A return to pre-ban PWC management practices under Alternative A, with fewer geographic restrictions, would increase the consumer surplus of PWC users slightly more than under Alternative B.

As with other activities, the extent of the welfare loss to an individual rider depends crucially on the availability of substitute areas to use PWC and/or to engage in other recreational activities. All else equal, individuals who have fewer substitutes for PWC use (either other places to use PWC or other activities they enjoy as much) enjoy greater consumer surplus from PWC use in a particular body of water and thus will experience a greater gain in welfare if that body of water is opened to PWC use.

After conducting an extensive review of the economics literature and consulting with the authors of existing studies, experts in recreation demand analysis at universities, and other experts, NPS was unable to locate a study that estimated the consumer surplus

associated with a PWC trip. Table 4-2 presents the results of a review of the recreation literature conducted by Rosenberger and Loomis (2000). The review found an average value of $49.37 (1996 dollars) per person per day for riding in motor boats (with estimates ranging from $15 to over $65). The same study reports a value of $26.79 (1996 dollars) per person per day (with estimates ranging from $20 to over $30) for off-road driving. Bhat et al. (1998) report consumer surplus estimates ranging from $9.12 to $54.93 for motorboating and waterskiing in different regions of the country. These estimates, along with the estimates in Table 4-2, provide a range of values for activities similar to riding PWC and provide a bound on the consumer surplus for PWC users expected from the regulations. Note that measures of net consumer surplus to PWC riders that do not account for the additional costs imposed on society by the negative externalities associated with PWC use will overstate the true net social welfare associated with the activity.

Even PWC users who do not currently visit the park may have a positive value associated with maintaining access for PWC in parks that they could potentially decide to visit in the future. These users hold an option to visit the park in the future. Restrictions on PWC access to parks would reduce or eliminate the value of that option. Thus, PWC users who do not visit the park may still experience a gain in welfare if the park allows PWC use. However, because information was lacking on the population of PWC users who may choose to visit a given park in the future and the value that they place on that option, NPS does do not attempt to quantify the potential gains in option value.

An increase in PWC use at a particular park may also affect businesses that offer services to PWC users. These businesses are not directly affected by NPS regulations of PWC users (i.e., none of the regulations directly require any action from PWC dealerships, rental shops, or other businesses), but they are likely to be affected nonetheless. For example, reinstating PWC use in national parks may lead to increased demand for PWC sales or rentals and decreased demand for motorboats or canoes. These shifts in demand may reallocate sales among businesses and may lead to an increase in total revenue for businesses providing tourism-related services. As described in Section 3, the local economy may also experience ripple effects. If businesses that serve PWC users

experience an increase in demand for their services, they will most likely increase their purchases of inputs from other sectors of the local economy, including labor. In addition, an increase in revenue for local firms tends to increase regional income. Increases in average household income for the region surrounding the park will also lead to increases in sales for local businesses as local households respond by purchasing more goods (see Appendix A for more detailed information on ripple effects).

Whether these indirect, or secondary, impacts should be included as a change in social welfare in the benefit-cost analysis depends on whether the change in demand or supply in the secondary market results in prices changes (for details, see a benefit-cost analysis textbook such as Boardman et al. [1996]). In general, when the policy change in the primary market (PWC trips to the national park) causes prices to change in the secondary markets, the net change in social welfare from the secondary market should be included in the benefit-cost analysis. If prices do not change in the secondary market, the revenue gains or losses should not be included in the benefit-cost analysis. If the people who would have used PWC in the national park spend their money elsewhere instead, this represents a transfer from one region of the country to another or from one business to another. Although the loss in revenue may hurt the businesses located near the national park, from society's point of view this represents a transfer of income rather than a true cost to society as a whole.

Without more detailed information, it is difficult to predict with certainty whether the alternatives will change prices for PWC sales or rentals. However, NPS believes it is quite possible that the changes in demand that would occur under these alternatives may result in price changes for PWC-related markets. Thus, losses or gains to tourism-related businesses that may be indirectly affected by the rule are included in the benefit-cost analysis.

4.2 RESULTS FOR CURECANTI NATIONAL RECREATION AREA

Based on the approach and possible impacts outlined above, this section presents the results of the benefit-cost analysis for CURE. The section discusses the groups most directly affected by the alternatives for managing PWC use in the park and several scenarios

for the possible levels of impacts. The benefits and costs accruing to these groups, relative to the baseline (where PWC are banned from CURE), are then presented.

4.2.1 Affected Groups

For the purpose of this study, six major affected groups, listed in Table 4-3, have been identified:

1. PWC users, in particular those who had previously used PWC in CURE and those who may wish to use PWC in CURE in the future.
2. Other visitors or potential visitors who may have a different experience at the park if PWC use is reinstated in CURE (canoeists, anglers, swimmers, hikers, boaters, and other visitors).
3. Producers of PWC services (e.g., PWC rental shops, PWC sales shops, restaurants, gas stations, hotels) in the area surrounding CURE who may experience a change in their welfare if PWC use in the park changes.
4. Local residents of the area surrounding CURE (not including those in any of the five other user groups).
5. Producers of services to other types of summer visitors (e.g., canoe rentals or powerboat rentals) who may experience a change in their welfare related to the number of PWC users in the park.
6. The general public who may care about the natural resources in CURE even if they do not visit the park.

The impacts on these groups under each alternative are discussed in more detail below.

Alternative A, which reinstates PWC use as managed prior to the November 2002 ban, has a negative effect on all user groups except for PWC users and the businesses that cater to them. NPS expects negative welfare effects for all users except PWC users, PWC dealerships, and other businesses that provide services to PWC users. Adverse impacts of PWC on swimmers, beach goers, and other users within CURE relative to the baseline are increased somewhat under this alternative because PWC are allowed within the park's boundaries as previously managed. PWC users, PWC dealerships, and other businesses that provide services to PWC users are expected to experience gains of consumer and producer surplus. In addition, allowing PWC in the park would have negative impacts on other boaters' consumer surplus because of the

Table 4-3. Impact of Alternatives on User Groups

User Group	Alternative A	Alternative B	Alternative C (No-Action Alternative)
1. PWC users	• Consumer surplus is expected to increase as a result of lifting the ban on PWC in CURE.	• Consumer surplus is expected to increase, although less than for Alternative A because of spatial restrictions on PWC use.	• No change in consumer surplus.
2. Other visitors or potential visitors: canoe users, anglers, other boaters, swimmers, hikers and other visitors	• Consumer surplus for current users of CURE is expected to decrease as a result of decreased solitude, increased noise, decreased water quality, and an increase in the risk of accidents involving PWC. • Consumer surplus is expected to decrease for potential visitors who would have visited CURE with a ban on PWC use.	• Consumer surplus for current users of CURE is expected to decrease as a result of decreased solitude, increased noise, and decreased water quality. Consumer surplus losses may be slightly less than under Alternative A, because of the creation of buffer zones along parts of the Blue Mesa Reservoir and Stevens Creek. • Consumer surplus is expected to decrease for potential visitors who would have visited CURE with a ban on PWC use, although this decrease may be slightly less than under Alternative A.	• No change in consumer surplus.

(continued)

Table 4-3. Impact of Alternatives on User Groups (continued)

User Group	Alternative A	Alternative B	Alternative C (No-Action Alternative)
3. Producers of PWC services: PWC rental shops PWC sales shops Other parts of the local economy providing services to PWC users	• PWC rental shops are expected to experience a small increase in producer surplus. • PWC sales shops are expected to experience an increase in producer surplus. • Other parts of the local economy such as hotels, restaurants, and gas stations located near CURE may have an increase in producer surplus.	• PWC rental shops are expected to experience a small increase in producer surplus. • PWC sales shops are expected to experience an increase in producer surplus. • Other parts of the local economy such as hotels, restaurants, and gas stations located near CURE may have an increase in producer surplus.	• No change in producer surplus.
4. Local residents of the area surrounding CURE	• Local residents of nearby areas are not expected to experience a measurable change in welfare.	• Local residents of nearby areas are not expected to experience a measurable change in welfare.	• No change in welfare.
5. Producers of services for Visitors to CURE who do not use PWC	• Producer surplus is expected to decrease because allowing PWC may result in a decrease in demand for other activities in CURE, resulting in decreased demand for the provision of services related to these activities.	• Producer surplus is expected to decrease because allowing PWC may result in a decrease in demand for other activities in CURE, resulting in decreased demand for the provision of services related to these activities.	• No change in producer surplus.
6. The general public who may Care about CURE even if they do not visit	• May experience a decrease in welfare as a result of diminished nonuse values resulting from decreased environmental quality.	• May experience a decrease in welfare as a result of diminished nonuse values resulting from decreased environmental quality.	• No change in welfare.

increased probability of accidents between boaters and PWC users and increased noise levels.

Alternative B is expected to have a very similar effect on all park user groups as Alternative A, because PWC would be restricted from only a very small additional portion of the waters of CURE.

Alternative C, which continues the ban on PWC, would have no effect on any user group relative to baseline conditions.

4.2.2 Scenarios

NPS considers the baseline conditions to which the alternatives are compared to be a ban on PWC use in CURE.

To develop estimates of the benefits and costs of the rule under each alternative, NPS used the scenarios described below. NPS considers the no-action alternative to be the baseline to which the alternatives are compared. It should be noted that under the baseline projections, park-related PWC rentals are assumed to have declined by 100 percent relative to the pre-ban levels, and park-related PWC sales and service revenues for shops in the region are assumed to have lost 95 percent of pre-ban related sales. In the baseline, it is also assumed that 20 percent of PWC users who, prior to the ban engaged in PWC use in CURE, no longer visit CURE for other recreational activities.

Alternative A

This alternative reinstates PWC use in CURE as previously managed prior to the November 2002 ban. Based on interview data, NPS assumes that PWC rental shops in the region will regain 100 percent of pre-ban PWC rental revenues related to CURE. In addition, NPS assumes that PWC sales and service shops in the region will regain their pre-ban park-related revenues.

Alternative B

The second alternative reinstates PWC use in CURE with additional geographic restrictions imposed by the creation of 100-foot buffer zones along the south shore of Blue Mesa Reservoir and Stevens Creek. For this alternative, NPS assumes that both PWC sales and rentals will return to 95 percent of pre-ban levels.

Alternative C (No-Action)

This alternative would maintain the ban on PWC from CURE. Under this alternative, NPS assumes there will be no impacts on revenues for businesses providing services to PWC users.

4.2.3 Costs

As described in Section 4.1 and Appendix B, PWC use in national parks can be linked to a wide variety of negative impacts. Allowing their use in these parks can therefore result in a number of different costs to society. Section 2.5 specifically describes the impacts on natural resources that are most likely to result from PWC use within the boundaries of CURE. This section describes how these impacts will be affected by the regulatory alternatives identified above and assesses the costs of these regulations. Assessing these costs in strictly quantitative (i.e., monetary) terms is not feasible with currently available data; therefore, the costs are described in qualitative terms.

The group of visitors who would bear the largest share of the costs associated with Alternatives A and B would be CURE visitors who do not use PWC and whose park experience would be negatively affected by the use of PWC in the park.

The group of visitors who would bear the largest share of the costs associated with Alternatives A and B would be CURE visitors who do not use PWC and whose park experience would be negatively affected by the use of PWC in the park. In CURE, other popular activities include wildlife viewing, bird watching, canoeing, diving, fishing, boating, camping, swimming, and hiking. Average annual visitation to CURE was 977,390 people from 1997 to 2001. Of those visitors, only about 0.28 percent were PWC users (see Section 2.2).

"Nonusers" of the park are also likely to experience costs as a result of the proposed measures (see Section 4.1 and Appendix B for more details). For example, individuals who do not visit the parks can experience a decline in welfare simply from the knowledge that the natural resources of the park may be degraded by PWC use. Part of this loss may stem from a decreased assurance that the quality of the park's resources is being protected for the enjoyment of future generations. Therefore, some of the cost categories described below, in particular those associated with the degradation of unique

park resources and ecosystems, may accrue in the form of nonuse values.[1]

Aesthetic Costs—Noise and Visibility Impacts

Alternatives that allow PWC use will increase noise levels in CURE and reduce the level of natural quiet along portions of the shoreline. They also have the potential to degrade visibility by leading to an increase in the amount of ozone-causing emissions. However, because motorized boats already operate along the shore in the baseline, and air quality and noise standards were being met prior to the PWC ban, the incremental negative impacts of allowing PWC in the park are likely to be relatively small.

Alternative A: This alternative will have the greatest impact because it will allow PWC in all pre-ban areas of CURE. However, noise from other boating activities is pre-existing in the baseline, and this alternative is not expected to result in an impairment of soundscape values (NPS, 2003). Thus, the incremental impact due to PWC use in the park is minor to moderately adverse in localized areas of CURE. It is expected that, with improved technology, quieter PWC will become the standard, and sounds generated by PWC will decrease over time.

Alternative B: This alternative will have much the same impact as Alternative A. Because this alternative restricts the use of PWC in 100-foot buffer zones along parts of the south shore of Blue Mesa Reservoir and Stevens Creek, impacts in these areas will be reduced relative to Alternative A.

Alternative C (No-Action Alternative): This alternative continues baseline management and offers no change in soundscape or visibility relative to baseline conditions.

Allowing PWC use under Alternative A or B will impose costs to recreators in the park, such as canoeists, anglers, birdwatchers, and

[1] The importance of recognizing these values is affirmed in the Organic Act. It established the fundamental purpose of the national park system, which includes providing for the enjoyment of park resources and values by the people of the United States. The mandate applies not just to the people who visit parks—but to all people—including those who derive inspiration and knowledge from afar. Furthermore, through the Redwood Act of March 27, 1978, Congress has provided that when there is a conflict between conserving national park resources and values and providing for enjoyment of them, conservation is to be the primary concern.

hikers, relative to baseline conditions. Noise emissions have been identified as a particular nuisance to nonmotorized recreators, such as canoeists and hikers, who tend to place a particularly high value on the tranquility and natural soundscape offered by the parks. Anglers using motorized boats also value the natural soundscape. Therefore, increasing noise from PWC activity in the parks will degrade the experience for both motorized and nonmotorized recreators.

In addition to generating high noise levels, PWC also emit strong-smelling fumes that can be bothersome to other recreators and reduce visibility. These effects tend to be much more localized than noise emissions. Finally, NPS assumes that visibility impacts from emission increases resulting from allowing PWC under these alternatives will be negligible.

Human Health Costs

PWC emissions contain relatively high levels of pollutants such as VOC, CO, PM, NO_x, and HCs, which are potentially damaging to human health. It is very unlikely that historic PWC use in CURE represented a significant health threat to humans; nevertheless, the potential for adverse health effects exists. For example, some of the toxic HCs are potentially harmful even at very low levels of exposure (EPA, 2000a; EPA, 1999a). The continued use of other motorized watercraft in CURE means that, even if PWC remain banned, there would only be a small decrease in emissions levels. In summary, for Alternatives A and B the human health costs associated with air quality are expected to be negligible and human health costs associated with water quality (fish consumption) are expected to be minor.

Ecosystem Degradation Costs

As discussed in Sections 2 and 4.1 of this report, PWC use has the potential to negatively affect ecosystems and natural habitats in a variety of ways. In the case of national parks, these natural resources are of particular value to the public. Although PWC use in CURE is not expected to cause widespread ecosystem damages, allowing PWC in the park can nonetheless cause damage to the welfare of visitors and nonusers by degrading some of the park's natural resources.

Alternative A: This alternative may have some negative impact on water quality. However, in general, allowing PWC in CURE as proposed under Alternative A is not expected to result in exceedances of ecotoxicological water quality benchmarks. Noise has the greatest potential to disturb wildlife in CURE. Localized, short-term effects on wildlife may occur as a result of reinstating PWC use in CURE. The PWC-specific incremental effect would be small because of the presence of other motorized watercraft.

Alternative B: Impacts to the ecosystem degradation would be similar to Alternative A. However, impacts are likely to be slightly smaller than under Alternative A because of the additional buffer zone restrictions.

Alternative C (No-Action Alternative): This alternative offers no costs to society for ecosystem degradation relative to baseline conditions.

As discussed in Section 2.5 of this report, PWC use has the potential to negatively affect fish and wildlife in a variety of ways. In addition to being a potential nuisance to other recreators, noise from PWC may disturb wildlife. Localized, short-term negligible to minor impacts on wildlife could occur under Alternative A or B, by increasing noise disturbance and the chance for collisions with wildlife. There could be a long-term negative impact to aquatic biota and the ecosystems in the park because of degradation in water quality and an increase in physical disturbances.

Introducing potential harm to the park's ecosystems will result in welfare losses for park visitors, for example by decreasing their chances of viewing wildlife in a less stressful environment. It will also result in welfare losses to individuals across the country who value the park's unique ecosystems and natural habitats, regardless of whether they actually visit the park. That is, degrading the park's ecosystems can result in losses to society.

Safety and Congestion Costs

In addition to environmental costs associated with increases in PWC use, there also may be safety and congestion costs. Since 1990, injuries associated with the recreational use of PWC have increased at least four-fold. The number of injuries reported from PWC use is now higher than that reported from motorboat use in the United

States (Branche, Conn, and Annest, 1997). Because of the disproportionately large number of injuries associated with PWC use, allowing their use may decrease the safety of park visitors. In addition, the level of congestion is an important factor determining visitor enjoyment. Increases in congestion related to PWC use may therefore have costs to other park users.

Alternative A: This alternative has the potential to increase PWC-related accidents in CURE relative to baseline conditions (where PWC are banned). The impacts under this alternative are expected to be negligible to minor.

Alternative B: Like Alternative A, this alternative has the potential to increase safety risks and congestion in CURE relative to baseline conditions. However, these risks may be reduced, slightly, relative to Alternative A, given the restrictions on PWC use along certain portions of the south shoreline of Blue Mesa Reservoir and Stevens Creek.

Alternative C (No-Action Alternative): This alternative would have no effect on safety and congestion in CURE relative to the baseline ban.

Any increase in PWC-related accidents will also increase the costs to NPS associated with medical/rescue operations, which may require resources to be redirected from other park management activities. However, these costs are not likely to be large in CURE.

4.2.4 Benefits

PWC users, as well as some businesses in the local area, may experience welfare gains as a result of the proposed alternative regulations.

Benefits to PWC Users

Two main groups of PWC users may be affected by the regulations: those who used PWC in CURE and those who use PWC in substitute areas outside CURE where PWC users displaced from CURE ride as a result of the ban in CURE.

PWC users who currently ride in areas where displaced riders from CURE may have visited will gain some consumer surplus if these areas are less crowded than under baseline conditions because of reinstating PWC use in CURE. For PWC users who rode in CURE or who want to ride in the park in the future, allowing PWC use in the park will result in consumer surplus gains.

PWC users who currently ride in nearby areas where displaced riders from CURE may visit will lose some consumer surplus if these areas become more crowded because of restrictions on PWC use in CURE. Although no studies were available that examined the impact of congestion on the value of a PWC trip, other recreation demand studies find that congestion lowers the value of a recreation experience (see Appendix B). For PWC users who rode in CURE or who want to ride in the park in the future, allowing PWC use in the park will result in consumer surplus gains. To the extent that individuals consider other PWC areas as close substitutes, the change in consumer surplus associated with allowing PWC use in the park will be lower. In the case of CURE, there are limited nearby substitute areas where PWC are permitted (see Section 2.3).

If each individual's demand curve for riding a PWC in CURE were known, then NPS could add up the gains of consumer surplus for each individual to find the total change in consumer surplus to PWC riders from the proposed management alternatives. Because the demand curve reflects the individual's preferences for available substitute activities and the cost of these activities, measuring the change in consumer surplus from a trip in the park takes into account substitute activities. In this case, NPS does not know the consumer surplus associated with PWC use in CURE, nor does NPS know the riders' next best alternative activities.

To assess the incremental change in consumer surplus for PWC users, NPS used the benefit transfer technique. After conducting an extensive review of the economics literature and consulting with the authors of existing studies, experts in recreation demand analysis at universities, and experts at consulting firms, NPS was unable to locate a study that estimated the consumer surplus for a PWC trip. A review of the recreation literature conducted by Rosenberger and Loomis (2000) found an average value of $31.98 (1996 dollars) per person, per day for riding in motor boats in the entire United States (with estimates ranging from $15 to over $50). Bhat et al. (1998) calculate an average consumer surplus of $45.61 (1998 dollars) associated with motorboating and waterskiing in an area that includes parts of the Rocky Mountain region of Colorado (along with the Rocky Mountain regions of Wyoming, Montana, and New Mexico.) Converted to 2001 dollars, the average consumer surplus reported in this study is $49.56. The estimate comes from a travel

cost model based on data from the Public Area Recreation Visitors Study (PARVS). The PARVS data was a multiagency survey that included on-site interviews of recreationists at over 350 sites across the United States between 1985 and 1992. For the benefit transfer, NPS used the value from Bhat et al. (1998) based on the following criteria:

- Waterskiing and motorboating are similar activities to PWC use.
- The region where the data were collected includes large bodies of water in the northeastern United States, like the coastline at CURE.
- Bhat et al. (1998) was published in a peer-reviewed journal. The authors estimate a travel cost model using data from on-site interviews and only estimate values for activities in a particular region for which at least 100 observations were collected.

Below NPS discusses the estimated impact of each proposed alternative on PWC users.

Alternative A: This alternative would reinstate PWC use in CURE as previously managed. All visitors using PWC in CURE prior to the ban are assumed to regain the full value of their consumer surplus for PWC use in CURE.

Alternative B: This alternative, much like Alternative A, would allow PWC use in CURE, but would create a 100-foot buffer zone along parts of the south shore of Blue Mesa Reservoir and Stevens Creek. These restrictions may cause PWC users that frequent this area to regain only a portion of their consumer surplus. However NPS expects the differences between consumer surplus gains under this alternative and Alternative A to be minor.

Alternative C (No-Action Alternative): Under Alternative C, NPS anticipates no change in PWC use as a result of the regulation. Consumer surplus to PWC users will remain unchanged from current conditions.

Using the value of $49.56 for a day of PWC use, NPS provides an estimate of possible incremental gains in consumer surplus to PWC users as a result of Alternatives A and B. For Alternative C, NPS assumes there would be no change in visitation to CURE by PWC users and no measurable change in consumer surplus. Table 4-4 summarizes the projected consumer surplus gains for PWC users in

Table 4-4. Projected Incremental Change in Consumer Surplus for PWC Users under Alternatives A and B, 2003-2012 ($2001)[a]

	Alternative A		Alternative B	
Year	Change in Number of People Using PWC	Change in Consumer Surplus ($)	Change in Number of People Using PWC	Change in Consumer Surplus ($)
2003	2,861	$141,800	2,718	$134,710
2004	2,918	$144,630	2,772	$137,400
2005	2,977	$147,520	2,828	$140,150
2006	3,036	$150,480	2,884	$142,950
2007	3,097	$153,480	2,942	$145,810
2008	3,159	$156,550	3,001	$148,730
2009	3,222	$159,690	3,061	$151,700
2010	3,287	$162,880	3,122	$154,740
2011	3,352	$166,140	3,185	$157,830
2012	3,419	$169,460	3,248	$160,990
PV (3%)[b]	NA	$1,318,050	NA	$1,252,160
PV (7%)[c]	NA	$1,078,570	NA	$1,024,650

[a]All impacts were rounded to the nearest $10. Columns may not sum to totals due to rounding.

[b]The economics literature supports a 3 percent discount rate in the valuation of public goods (e.g., Freeman, 1993). Federal rule-makings also support a 3 percent discount rate in the valuation of lost natural resources use (61 FR 453; 61 FR 20584).

[c]Office of Management and Budget (OMB). 2002. "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs: Memorandum for Heads of Executive Departments and Establishments." OMB Circular A-94, revised January 22, 2002.

CURE for Alternatives A and B and the no-action alternative from 2003 to 2012 and the present value (PV) of these gains using both 3 percent and 7 percent discount rates. PV is the value of a future stream of benefits or costs, discounted to current years. Depending on the discount rate and scenario, the PV of consumer surplus gains for PWC users in CURE from Alternatives A and B from 2003 to 2012 ranges from approximately $1,024,650 to $1,318,050.

Uncertainty: The estimates of consumer surplus gains to PWC users are uncertain for a variety of reasons. Some of the main sources of uncertainty are as follows:

- The estimates of the number of PWC users expected to visit CURE under each of the alternatives are uncertain, as are the projections of future PWC use.

- The actual consumer surplus associated with PWC use in CURE may be different from the value used in the analysis. In addition, the value is based on a full day of motorized water-based recreation. Many PWC users at CURE are renters and use PWC for only a small fraction of the day, spending the rest of the day engaged in more traditional beach activities. To the extent that these visitors represent a large share of total PWC users at CURE, consumer surplus for PWC users may be closer to non-PWC users' surplus value (estimated in 4.2.3) than to other motorized watercraft users' surplus.
- The values in Table 4-4 may overestimate true gains under Alternative B because of assumptions about the consumer surplus of PWC users who ride in the park. In the analysis of Alternative B, PWC users who continue to use PWC in CURE may be inconvenienced by the creation of buffer zones. These restrictions may decrease the consumer surplus associated with using a PWC in CURE.
- The 1996 EPA Marine Engine Rule may result in lower PWC use if the cost of new machines increases. If fewer riders would visit the park, the incremental consumer surplus gains associated with Alternative A or B would be lower.

Benefits to the Local Area Businesses

If PWC use increases as a result of the regulation, then the suppliers of PWC rental, sales, and service will be directly affected. In addition, lodging establishments, restaurants, gas stations, and other businesses that serve PWC riders could experience an increase in business from the regulation. The following section describes the approach used to develop quantitative estimates of these impacts and reports the results of the cost analysis for local area businesses.

PWC Sales and Rental Services. NPS identified one PWC rental concession located on Blue Mesa Reservoir. One business that sells PWC and one that services PWC were identified in Gunnison. One business that sells PWC and one that services PWC were identified in Montrose, and two sales shops with revenues related to CURE were identified in Grand Junction. These businesses are assumed to be affected by changes to PWC regulations in CURE.

Lodging Establishments, Restaurants, Gas Stations, and Other Businesses. Purchases made by PWC users contribute to total economic activity in the area surrounding CURE. It is possible that localized impacts on tourism-related businesses located near CURE will occur if PWC regulations result in increased visitation to the recreation area. However, historically PWC users comprised a

small fraction of total visitation to CURE. Therefore, lodging establishments, restaurants, gas stations, and other businesses that serve PWC riders are not likely to experience a substantial increase in business under any of the proposed alternatives reinstating PWC use.

NPS does not expect Alternative C to result in revenue gains to firms relative to the baseline. Based on the existing data and interviews with local businesses, NPS calculated revenue gains under Alternatives A and B for the following business categories: PWC rentals, PWC sales, lodging, restaurants, supermarkets, gasoline, local transportation, admissions/fees, and souvenir/retail shops. These revenue gains are presented in Table 3-4.

PWC rental shops are projected to gain $17,690 under Alternative A and $16,800 under Alternative B. PWC sales are expected to gain $410,200 and $382,860 under Alternatives A and B, respectively. These two categories represent approximately 98 percent of the total expected gains for businesses. Restaurants and bars are projected to gain approximately $2,700 in revenues, while souvenirs and other retails are projected to gain $1,300 to $1,400 in revenues, depending on the alternative selected. The remaining business categories (lodging, supermarkets, gasoline and oil, local transportation, and admissions/fees) are expected to gain a total of $4,950 to $5,220, depending on the alternative selected.

To translate increased PWC revenue into producer surplus gains for purposes of benefit-cost analysis, NPS used estimates of the increase in revenue associated with the rule and the return-on-sales measure for the Standard Industrial Classification (SIC) code provided by Dun & Bradstreet (D&B). The use of this profit margin only approximates gains in producer surplus. Producer surplus captures the difference between marginal costs and marginal revenue, while return on sales contains other measures reflecting fixed costs, taxes, and/or accounting conventions rather than measures of variable profits. For this reason, the use of D&B accounting profit margin data may understate producer surplus gains.

The profit ratios presented in Table 4-5, net profit after tax divided by sales, come from D&B (2001).[2] The upper quartile profit ratio for sales shops is 4.6 percent and the lowest quartile is 0.6 percent.

Table 4-5. Profit Ratios Used for Calculating Producer Surplus Losses

	Profit Ratios		
	SIC	Bottom Quartile	Upper Quartile
PWC rentals	7999	3.9%	8.7%
PWC sales	5571	0.6%	4.6%
PWC storage	7999	3.9%	8.7%
Restaurants and bars	5812	0.6%	7.5%
Grocery stores	5411	0.4%	3.0%
Gas and oil	5541	0.1%	3.1%
Souvenir shops and other retail establishments	5947	1.1%	9.9%

The upper quartile profit ratio for rental shops is 8.7 percent and the lowest quartile is –3.4 percent. However, none of the rental shops that NPS interviewed indicated that they had a negative profit margin. Therefore, NPS used the median profit ratio (3.9 percent) as the low value in this analysis.

For businesses in the CURE region, estimated producer surplus gains associated with imposing the regulatory alternatives relative to a 2002 baseline are presented in Table 4-6.[3] Total producer surplus gains expected under Alternative A range from $3,220 to $21,170. Under Alternative B, estimated total producer surplus gain ranges from $3,010 to $19,640. The largest increase in producer surplus occurs in the PWC sales and service category, with increases ranging from $2,300 to $18,870 across these alternatives. Producer surplus gains for other affected categories range from $0 to $1,540, depending on the business category, the alternative, and the profit

[2]Dun & Bradstreet data for NAICS codes are not currently available. Therefore, NPS used the comparable SIC code 5571 (Motorcycle Dealers) as defined by the U.S. Census (i.e., SIC 5571, Motorcycle Dealers) for PWC dealerships. For rental shops, NPS used SIC code 7999 (Amusement and Recreation NEC).

[3]Estimated producer surplus losses in future years have a similar distribution across industries.

Table 4-6. Changes in 2002 Producer Surplus Resulting from Reinstating PWC Use in CURE (2001$)[a]

	Alternative A		Alternative B		No Action	
	Low	High	Low	High	Low	High
PWC rentals, storage and other PWC related purchases	$690	$1,540	$660	$1,460	$0	$0
PWC sales/service	$2,460	$18,870	$2,300	$17,610	$0	$0
Lodging	$10	$160	$10	$120	$0	$0
Restaurants and bars	$20	$210	$10	$160	$0	$0
Groceries/take-out	$10	$40	$0	$30	$0	$0
Gas and oil	$0	$40	$0	$30	$0	$0
Souvenirs and other retail	$30	$310	$30	$230	$0	$0
Total	**$3,220**	**$21,170**	**$3,010**	**$19,640**	**$0**	**$0**

[a]All impacts were rounded to the nearest $10. Columns may not sum to totals due to rounding.

ratio used. Under Alternative C, there are no projected gains in producer surplus.

Table 4-7 summarizes the estimated change in producer surplus for the period from 2003–2012. The PV of incremental gains in producer surplus for Alternative A is between $29,070 and $191,040 with a 3 percent discount rate and $22,900 to $150,490 when a 7 percent discount rate is used. For Alternative B, the PV of producer surplus gain is estimated to be $27,160 to $177,240 using a 3 percent discount rate and $21,390 to $139,620 using a 7 percent discount rate. There is no change in producer surplus under Alternative C, the no-action alternative.

Uncertainty

A number of factors will affect local business revenue and producer surplus gains associated with the proposed alternatives. Important factors include the uncertainty surrounding the baseline visitation projections as described in Section 2.2, uncertainty concerning the estimation of output increases as described in Section 3.2.8, and the use of national average accounting profit ratios to approximate producer surplus gains to individual local businesses.

NPS Enforcement Costs

As a result of lifting the ban on PWC use in CURE, costs are expected to be incurred by taxpayers to support an increase in

Table 4-7. Changes in Producer Surplus Resulting from Reinstating PWC Use in CURE, 2003–2012 (2001$)[a]

Year	Alternative A		Alternatives B		Alternative C (No Action)	
	Low	High	Low	High	Low	High
2003	$3,220	$21,170	$3,010	$19,640	$0	$0
2004	$3,280	$21,590	$3,070	$20,030	$0	$0
2005	$3,350	$22,020	$3,130	$20,430	$0	$0
2006	$3,420	$22,460	$3,190	$20,840	$0	$0
2007	$3,490	$22,910	$3,250	$21,260	$0	$0
2008	$3,560	$23,370	$3,320	$21,690	$0	$0
2009	$3,630	$23,840	$3,390	$22,120	$0	$0
2010	$3,700	$24,320	$3,460	$22,560	$0	$0
2011	$3,770	$24,810	$3,530	$23,010	$0	$0
2012	$3,850	$25,310	$3,600	$23,470	$0	$0
PV (3%)[b]	**$29,070**	**$191,040**	**$27,160**	**$177,240**	**$0**	**$0**
PV (7%)[c]	**$22,900**	**$150,490**	**$21,390**	**$139,620**	**$0**	**$0**

[a]All impacts were rounded to the nearest $10. Columns may not sum to totals due to rounding.

[b]The economics literature supports a 3 percent discount rate in the valuation of public goods (e.g., Freeman, 1993). Federal rule-makings also support a 3 percent discount rate in the valuation of lost natural resources use (61 FR 453; 61 FR 20584). While the welfare impacts in this case are for private goods, the 3 percent discount rate was used to be consistent with discounting of other impacts in this report.

[c]Office of Management and Budget (OMB). 2002. "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs: Memorandum for Heads of Executive Departments and Establishments." OMB Circular A-94, revised January 22, 2002.

enforcement efforts by park staff. Although NPS expects that additional staff may be required under Alternatives A and B relative to the baseline, the number of staff (if any) that would be hired is uncertain.

Consequently, NPS does not quantify enforcement costs associated with the implementation of Alternatives A and B. Alternative C, which continues baseline conditions, will not result in any additional enforcement costs for CURE.

4.3 SUMMARY

Alternative C, the no action alternative, maintains the baseline in this analysis. Under that alternative, all PWC use would remain prohibited from the park. Alternative B would permit PWC use with certain restrictions, and Alternative A would permit PWC use as

previously managed in the park (pre-ban). The benefits of any alternative are measured relative to the baseline conditions, which are represented by Alternative C. Therefore, there are no incremental benefits associated with Alternative C. The primary beneficiaries of Alternative A or B would be the park visitors who use PWC and the businesses that provide services to PWC users such as rental shops, restaurants, gas stations, and hotels. Additional beneficiaries include individuals who use PWC outside the park where PWC users displaced from the park may decide to ride if PWC use within the park were prohibited.

Benefits accruing to individual PWC users are called consumer surplus gains, and those accruing to businesses are called producer surplus gains. Consumer surplus measures the net economic benefit obtained by individuals from participating in their chosen activities, while producer surplus measures the net economic benefit obtained by businesses from providing services to individuals. Over the period 2003 to 2012, the PV of consumer surplus for PWC users is expected to increase by $1,024,650 to $1,318,050 and producer surplus is expected to increase by $21,390 to $191,040 if PWC use in the park is reinstated, depending on the assumptions used. These benefits, projected over a 10-year horizon, are summarized in Table 4-8.

Table 4-8. Present Value of Projected Incremental Benefits Under Alternatives A and B, 2003–2012 (thousands)

	PWC Users	Businesses	Total
Alternative A			
Discounted at 3%[a]	$1,318,050	$22,900 – $191,004	$1,340,950 – $1,509,090
Discounted at 7%[b]	$1,078,570	$22,900 – $150,490	$1,101,470 – $1,229,060
Alternative B			
Discounted at 3%[a]	$1,252,160	$27,160 – $177,240	$1,279,320 – $1,429,400
Discounted at 7%[b]	$1,024,650	$21,390 – $139,620	$1,046,040 – $1,164,270

[a]The economics literature supports a 3 percent discount rate in the valuation of public goods (e.g., Freeman, 1993). Federal rule-makings also support a 3 percent discount rate in the valuation of lost natural resources use (61 FR 453; 61 FR 20584). While the welfare impacts in this case are for private goods, the 3 percent discount rate was used to be consistent with discounting of other impacts in this report.

[b]Office of Management and Budget (OMB). 2002. "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs: Memorandum for Heads of Executive Departments and Establishments." OMB Circular A-94, revised January 22, 2002.

As with the benefits described above, the costs of any alternative are measured relative to the baseline conditions, which are represented by Alternative C. Therefore, there are no incremental costs associated with Alternative C. The primary group that would incur costs under Alternative A or B are the park visitors who do not use PWC and whose park experiences would be negatively affected by PWC use within the park. At CURE, non-PWC users include boating, canoeing, fishing, and hiking. Additionally, the public could incur costs associated with impacts from Alternative A or B to aesthetics, ecosystem protection, human health and safety, congestion, nonuse values, and enforcement. However, these costs could not be quantified because of a lack of available data.

Because the costs of the alternatives are not quantified, the benefits presented in Table 4-8 represent the quantified net benefits of Alternatives A and B. As noted above, these net benefits do not account for the costs of enforcement; the costs to non-PWC users; or those costs relating to aesthetics, ecosystem protection, human health, and safety, congestion, or nonuse values as a result of a lack of available data. Therefore, these net benefit estimates do not reflect all costs. If all costs could be incorporated, the indicated net benefits for each alternative would be lower.

From an economic perspective, the selection of Alternative B as the preferred alternative was considered reasonable because certain costs could not be quantified in the net benefits presented above. Those costs, relating to non-PWC use, aesthetics, ecosystem protection, human health and safety, congestion, or nonuse values, would likely be greater for Alternative A than for Alternative B. Given that the quantified net benefits of Alternatives A and B are assumed to be similar (see Table 4-6), further inclusion of these unquantified costs could reasonably result in Alternative B having the greatest level of net benefits. Therefore, based on these factors, Alternative B is considered to provide the greatest level of net benefits.

5 Small Entity Impact Analysis

Alternatives A and B are expected to have positive effects relative to baseline conditions, while Alternative C has no incremental impacts.

Changes to the management of PWC use in national parks potentially affect the economic welfare of a number of businesses, large and small. However, small entities may have special problems in complying with such regulations. The Regulatory Flexibility Act (RFA) of 1980, as amended in 1996, requires special consideration be given to these entities during the regulatory process.

To fulfill these requirements, agencies must perform a review to determine whether a proposed or final rule will have a significant economic impact on a substantial number of small entities. This section assesses the potential for PWC regulations in CURE to affect small businesses. Expected changes in revenues across firms and regional economic impacts are discussed in Section 3, and expected changes in producer surplus are discussed in Section 4.

5.1 IDENTIFYING SMALL ENTITIES

As described in Sections 2 and 3, NPS attempted to identify the firms in the region surrounding CURE that would experience the most significant impacts as a result of PWC regulations in CURE. Small entities potentially affected by the regulations include companies providing PWC rentals, sales, and service; restaurants; grocery stores; and other retail businesses. The small expected changes in visitation to the area as a result of implementing Alternative A or B suggest that there will be limited regional impacts on restaurants, grocery stores, or other retail businesses. It is possible that these tourism-related industries may experience

localized impacts in communities located adjacent to CURE, but any impacts are expected to be small relative to the impacts estimated for businesses that provide PWC sales, rentals, and service. The impacts on the PWC-related businesses considered here are believed to be representative of the upper bound of impacts that would be experienced by local businesses under Alternative A or B. Under Alternative C, the no-action alternative, no incremental impacts are expected for small businesses because it maintains baseline management conditions under which PWC were banned from CURE in November 2002.

NPS identified seven PWC rental, sales, and service shops in communities near CURE. Four of the seven firms were interviewed to collect data on total revenue, the share of revenue made up by PWC-related business, and the share of PWC revenue that was related to PWC use in CURE to obtain PWC revenue estimates, total revenue estimates, and park-related PWC revenue estimates.

For the remaining three firms, NPS used the midpoint of the sales range reported for the firm by *Info*USA (2002). For companies with sales less than $500,000, it was assumed total company revenue equaled $250,000 (which is the midpoint of $0 and $500,000).

NPS considered all of the six directly affected firms as small for this analysis.

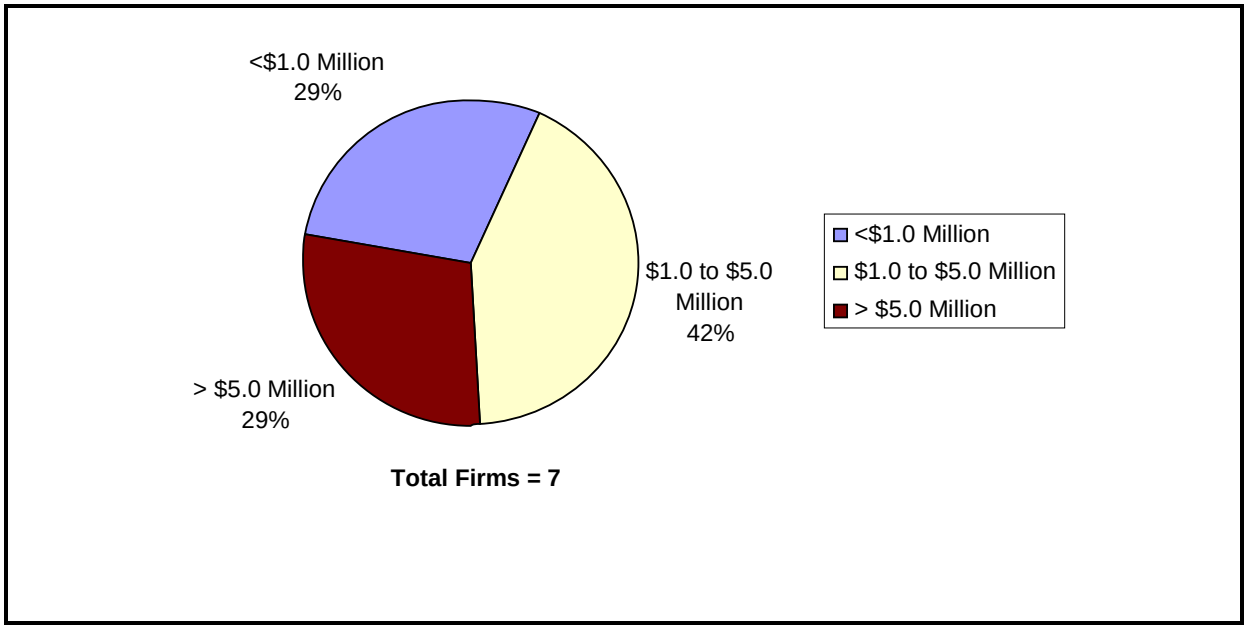
The SBA's general size standard definitions for these industries (NAICS 532292—Recreational Goods Rental[1] and NAICS 441221—Motorcycle Dealers[2]) classify companies with annual sales less than or equal to $5 million as small. Two of these companies are estimated to have less than $1.0 million in annual sales (29 percent), three are estimated to have annual sales between $1.0 million and $5.0 million (43 percent), and two are estimated to have annual sales above $5.0 million (29 percent). After additional review and data collection, NPS determined two of the seven firms are owned by large companies with sales exceeding $5 million. Using the SBA criterion and reported sales data, NPS classified five of the seven firms as small businesses. NPS estimated that these seven firms had a total of $44.8 million in annual revenue in 2000.

[1]This industry comprises establishments primarily engaged in renting recreational goods, such as bicycles, canoes, motorcycles, skis, sailboats, beach chairs, and beach umbrellas.

[2]This industry comprises establishments primarily engaged in retailing new and/or used motorcycles, motor scooters, motor bikes, mopeds, off-road all-terrain vehicles, and PWC or retailing these new vehicles in combination with repair services and selling replacement parts and accessories.

The distribution of total company sales for the seven firms is shown in Figure 5-1.

Figure 5-1. Distribution of Small Firms by Sales Range



5.2 ASSESSMENT

Do the proposed regulations have a significant negative impact on a substantial number of small entities?

Alternative A: No

Alternative B: No

Alternative C: No

After considering the economic impacts of the PWC regulations in CURE on small entities, NPS concludes that none of the management alternatives will have a significant negative impact on a substantial number of small businesses. Alternatives A and B will have a positive impact on small businesses relative to the baseline scenario, under which PWC were banned from CURE in November 2002. The no-action alternative (Alternative C) will not have a significant negative impact on a substantial number of small entities because it will not result in a change from baseline conditions. NPS made the determination that these management alternatives would not have a significant negative impact on small entities using RFA implementation guidance provided by other agencies (NMFS, 2000; EPA, 1999b; SBA, 2003) and provides the following factual basis for this determination:

- This rule is not expected to reduce any of the area businesses' profit margins or reduce the competitiveness of the PWC rental and retail businesses.

- NPS projects increases in revenue relative to the baseline for firms selling and renting PWC to CURE visitors under Alternatives A and B.
- NPS projects slightly higher overall levels of revenue for other businesses (including restaurants, grocery stores, gas stations, and souvenir shops) in the CURE region relative to the baseline under Alternatives A and B.
- NPS projects no change in revenue for local small businesses relative to baseline conditions under Alternative C, the no-action alternative.

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Appendix A: Economic Impact Analysis

Expenditures made by visitors to national parks have a variety of economic impacts on the region where the park is located. For instance, tourists contribute to sales, profits, jobs, tax revenues, and income in a region. The most direct effects are felt within the primary tourism sectors: lodging, dining, transportation, entertainment, and retail trade. However, when indirect effects are included, almost all sectors of the economy are affected by tourism. This occurs because spending by tourists on the primary tourist sectors leads those sectors to purchase inputs into their production process from other industries, which then purchase more inputs themselves and so on. In addition, as local household income rises because of the impact of tourism, these households purchase more goods and services from many different industries. This leads to higher incomes for households deriving income from these other industries, which causes them to purchase more goods and services as well. These feedback effects continue indefinitely, but become smaller and smaller in each round as a result of leakage because not all income is spent within the regional economy. These effects on household spending are known as induced effects.

A simple example from Stynes (2000) illustrates this point. Assume a region attracts an additional 100 tourists, each spending $100 per day. The direct impact of this increase in tourism is $10,000 per day in new spending. If sustained over a season of 100 days, the region would experience an increase in sales of $1 million. This spending would primarily take place in the lodging, dining, entertainment, and retail sectors in proportion to how each visitor spends his/her $100. Not all of the value of this spending can be

assumed to accrue within this region because the cost of goods made in other regions should not be included as a direct sales effect in the local area. For example, gasoline purchased by tourists for $1.50 per gallon should not be included as a local spending impact of $1.50 per gallon. Instead, only the retail margin on the gasoline can be considered a direct effect of tourism spending. The margins on gasoline are relatively small. Assuming a retail margin of 12 percent suggests that the direct impact of spending on gasoline to the local area is only about 18 cents per gallon. Wholesale margins are also included for wholesalers located within the region of interest.

Returning to the example above, perhaps 30 percent of the million dollars in direct spending would leak out of the area to cover the costs of goods purchased by tourists that were produced outside the region. The remaining $700,000 increase in direct sales might yield $350,000 in income within tourism-related industries and support 20 jobs directly linked to tourism. Tourism industries tend to be labor intensive, translating a relatively high proportion of sales into income and jobs.

The tourism industry buys goods and services from other industries located in the area to provide the goods and services offered to tourists. For example, changes in sales, jobs, and income in the linen industry (an industry supplying products to hotels) will result from changes in hotel sales. Also, as mentioned above, this industry is typically very labor intensive. Therefore, most of the $350,000 in income will be paid as wages and salaries to tourism industry employees. As a result of this increase in income, these employees will spend more in the local region for an array of household products and services. Assuming a sales multiplier of 2.0 to indicate that each dollar of direct sales generates another dollar of secondary sales implies that the $700,000 in direct sales within the region leads to a $1.4 million increase in regional sales as a result of the additional tourists visiting the area. These secondary sales create additional income and employment in the region, with the estimated impact dependent on the multipliers for each particular region. Assume in our case that the total impact of the increase in tourism after applying multipliers is $1.4 million in sales, $650,000 in income and 35 jobs.

Although hypothetical, the numbers used in this example are fairly typical of those used in a tourism economic impact study. Through indirect and induced effects, changes in tourist spending can affect almost every sector of the economy to some extent. The magnitude of these effects depends strongly on the extent to which businesses and households in the region purchase goods and services from local suppliers as well as how much household income is affected by the changes in spending. When a large employer closes a plant, the entire local economy may be negatively affected as retail stores close and leakages of spending from the region increase as consumers go outside the region for more of their goods and services. Similar effects in the opposite direction are observed when a new facility opens and there is a significant increase in household income (Stynes, 2000).

In addition to simply estimating the total regional impact, more detailed studies identify the sectors that receive the direct and secondary effects. They may also identify distinct market segments and identify differences in spending and impact between these subgroups. This information is sometimes used to target marketing efforts towards tourists with particular characteristics that are likely to lead to the largest economic impact per marketing dollar. It may also be used simply to better understand the distribution of impacts and to gain a better measure of the expected effects of a change in regional spending. Effects on tax revenues may also be examined by applying local tax rates to changes in sales and income.

The economic impacts resulting from a change in spending are typically measured by

- ➤ estimating the change in the number and types of visitors to the region due to the proposed change in policy,
- ➤ estimating average levels of spending (often within market segments) of visitors in the local area, and
- ➤ providing the estimated change in direct spending as input into a regional economic model to determine secondary effects.

Estimates of changes in visitor activity usually come from a demand model or professional judgment about the changes in visitation likely to take place. This step is often the weakest link in tourism impact studies because most regions do not have accurate counts of

visitors, let alone models for predicting changes in visitation (Stynes, 2000).

Spending averages are usually derived from visitor surveys or may be adapted from other similar studies. Because of differences in visitors, these data are often provided for different segments of the visitor population due to variations in spending patterns based on whether visitors stay overnight, the accommodations they choose, the type of transportation they are using, and other characteristics of their stay.

One of the primary methods used to estimate the secondary economic impacts of a particular action or policy is to apply an input-output (I-O) model. I-O models are mathematical models that describe the relationship between sectors in a region's economy. Regional I-O models are commonly used to estimate the benefits or costs of an event on the economy of a given region. These models are used to estimate linkages among sectors of the economy such that an event directly affecting one sector of the economy can be traced through the impact on the entire regional economy. This approach permits estimation of both the direct impacts in the affected sector as well as indirect impacts that occur as the change in spending by the directly affected industry works its way through the economy. Based on production functions estimating the inputs that each industry must purchase from every other industry to produce their output, these models predict flows of money between sectors. These models also determine the proportion of sales that end up as income and taxes. Multipliers are estimated from I-O models based on the estimated recirculation of spending within the region. The higher the propensity for households and firms within the region to purchase goods and services from local services, the higher the multipliers for the region will be. A number of important assumptions are involved in using I-O models. Some of the basic assumptions include the following:

- **Constant Returns to Scale.** Each industry's production function is assumed to have constant returns to scale. This means that, to produce additional output, all inputs increase proportionately (i.e., if output in an industry were to double, then that industry would double its use of all inputs). Because labor is one of the inputs into production, this implies that jobs will change in exactly the same proportion as output.

- **No Supply Constraints.** Supplies are unlimited. All industries have access to unlimited quantities of raw materials at a constant price with output limited only by demand.
- **Fixed Commodity Input Structure.** This assumption implies that price changes do not cause a firm to purchase substitute goods. This structure assumes that changes in the economy affect the industry's output but not the mix of inputs it uses to make its products.
- **Homogeneous Sector Output.** The proportion of all the commodities produced by an industry will remain the same, regardless of total output. An industry will not increase the output of one product without proportionately increasing the output of all its other products.
- **Industry Technology Assumption.** This assumption is important when data are collected on an industry-by-commodity basis and then converted into industry-by-industry data. It assumes that an industry uses the same technology to produce all of its products. In other words, an industry has a primary product and all other products are by-products of the main product.
- **Identical Firms.** All firms in a given industry employ the same production technology and produce identical products.
- **Model Parameters.** The various model parameters are accurate and represent the current year. These models rely on the national system of accounts to generate model parameters based on standard industrial classification codes and various federal government economic censuses. They are usually at least a few years out-of-date, although this is not usually a major problem unless the region has changed significantly.
- **Induced Effects.** Multiplier computations for induced effects assume that jobs created by additional spending are new jobs involving local households. The induced effects of new spending are calculated assuming linear changes in household spending with changes in income.

These assumptions are necessary to estimate an economic impact model using a typical regional I-O model. However, these assumptions lead to several limitations as noted by Hamilton et al. (1991); Coughlin and Mandelbaum (1991); and Stabler, Van Kooten, and Meyer (1988), among others. Most of these issues apply to alternative models as well and should be considered in interpreting the results of economic impact analyses in general. Some of the biggest limitations associated with this type of analysis are discussed below.

First, all production inputs have an associated opportunity cost. Thus, these opportunity costs should be included in the net benefits calculation, although this is often not considered in an economic impact analysis. Net benefits equal impacts less opportunity costs. In the case of full employment, perfect resource mobility, and absence of scale economies, benefits of a policy, action, or project would be zero because all factors employed as a result could have received the same return without the policy, action, or project in alternative uses. Typically, applications analyzing regional economic analysis assume that there is not full employment and complete mobility in the region being analyzed, but the change in net benefits will still be reduced if opportunity costs are considered.

Another issue is that multipliers estimate short-term changes, ignoring a regional economy's long-term adjustments. Thus, most of the economic effects identified in economic impact analysis are likely to be only transitory as the regional economy adjusts to the change. For example, if jobs are lost in a region because of new regulations, some of this reduction will be temporary because some of the workers whose jobs were eliminated will find new jobs in the region.[1]

Also, if some workers relocate in response to a change in the regional economy, then it is not entirely clear who should be counted in the region when calculating the benefits and costs associated with a change. For example, a new project located in a particular region may attract resources from outside the region. It is not clear that income to these immigrant resources should be counted as regional benefits of the project because people originally from the region do not benefit. However, I-O models typically make no distinction between jobs and sales, for example, going to those people already within the region and benefits going to those people outside the region.

Furthermore, applying multipliers is difficult if industries will move to different points on their cost curves as a result of the change and there are economies or diseconomies of scale. Because I-O models are based on fixed coefficients, they are not able to capture these

[1] Some workers may not find jobs within the region, even in the long run. The loss of workers who leave for jobs in other regions may tend to slow the region's growth, but such restructuring ultimately improves national economic performance by redistributing resources to their most efficient use.

impacts. These models assume that there are no supply constraints such that industries will not change their relative purchases from other sectors. This requires excess regional production capacity and excess regional labor so that use of these resources can be increased without a change in prices. In many areas, this is unlikely to be the case. Instead, increasing scale may lead to an increase in the price of labor and other resources and may cause a change in the mix of inputs used for production. It may also lead to the use of a different proportion of inputs being purchased from outside the region, which will affect the estimated change in final demand for regional output.

Some additional difficulties with applying regional multipliers include the following:

- multipliers are based on political boundaries (e.g., counties, states) instead of economic areas;
- multipliers may not be constant over time;
- different production functions for different activities are lumped together; and
- information on the relationships between producers in a region is lacking, which makes constructing an accurate set of multipliers very difficult.

Despite these caveats on the use of multipliers, regional I-O models are still considered the best way currently available to cost-effectively estimate the regional impacts of a change that will affect the local economy.

Appendix B: Social Benefits and Costs of Personal Watercraft Restrictions

The purpose of benefit-cost analysis is to evaluate the social welfare implications of a proposed action—in this case the regulation of PWC use in national parks. That is, it assesses whether the action generates benefits to society (gains in social welfare) that are greater than the costs (losses in social welfare). The following sections provide detailed descriptions of the range of social benefits and social costs that may result from PWC restrictions and discuss the ways in which these benefits and costs can be conceptualized and measured.

B.1 SOCIAL BENEFITS OF PWC RESTRICTIONS

PWC use in national parks may be associated with a number of negative impacts on environmental resources and ecosystems. One result of any negative impacts that occur is that they impose welfare losses on individuals who value the parks' environmental systems. The benefits of PWC restrictions can therefore be thought of and measured as the reduction in these losses to society. In addition, PWC use can negatively affect society in ways that are not directly related to the environment; therefore, the benefits of PWC restrictions must also include reductions in these nonenvironmental losses. Both broad categories of benefits—environmental and nonenvironmental—are discussed in more detail below.

B.1.1 Environmental Benefits

The use of PWC may have adverse impacts on the aesthetic qualities of the park, on human health, and on the park's ecosystems. The benefits associated with avoiding these impacts are described below.

Aesthetic Benefits

Among the largest and most directly damaging impacts associated with PWC use in national parks are its effects on the aesthetic qualities of park air and specifically the park soundscape. The natural soundscape is considered a natural resource of the park, and NPS attempts to prevent or minimize unnatural sounds that adversely affect the natural soundscape. National parks are especially valued for their pristine and undisturbed environments, which are often experienced by visitors through natural vistas and through the relative absence of visible or audible human activity (NPS, 2000b). The improvement or preservation of these aesthetic qualities, either in the form of reduced noise pollution or improved visibility, is therefore a potentially important source of benefits from reducing PWC use.

Noise Reduction. Perhaps the most noticeable and intrusive aspect of PWC is the level of sound they emit during normal operation. PWC have been measured to emit 65 to 105 decibels (dB) per unit, which may disturb visitors on the land and on the water. Noise limits established by NPS require vessels to operate at less than 82 dB at 82 feet (from the shoreline). The amount of noise from a PWC can vary considerably depending on its distance from another park visitor and whether it is in the water or in the air. Noise dissipates by 5 dBs for each doubling of distance from a 20-foot circle around the source and a PWC that is airborne is 15dBA louder than one that is in the water (Komanoff and Shaw, 2000). To put these noise-level estimates into perspective, Table B-1 also compares them with those of other familiar sounds.

PWC users tend to operate close to shore, to operate in confined areas, and to travel in groups, making noise more noticeable to other recreationists. Noise impacts from PWC use are caused by frequent changes in pitch and loudness due to rapid acceleration, deceleration, and change of direction. PWC noise intrudes in

Table B-1. Comparative Noise Emissions

Source	Decibel Level
Firearms	140
Motorcycle	90–110
Snowmobiles	73–100
Vacuum cleaner	70
PWC	65-105
Normal conversation	60
Normal breathing	10

otherwise quiet soundscapes, such as in secluded lakes, coves, river corridors, and backwater areas. Also, PWC use in areas where there are nonmotorized users (such as canoeists, sailors, and kayakers) causes conflicts between users.

Those who are most likely to benefit from reductions in PWC-related noise pollution in national parks are other park visitors and recreators, in particular those engaged in recreational activities that take place by the water, such as fishing, hiking, birdwatching, canoeing, kayaking, and swimming.

Several studies have shown that noise from motorized vehicles diminishes the recreational experience of other users. Several studies have found disamenities associated with various forms of mechanized recreational activities or other "technology-related" noises in recreation areas (Beal, 1994; Ivy, Stewart, and Lue, 1992; Bury and Luckenbach, 1983; Baldwin, 1970; Bury, Wendling, and McCool, 1976; Dunn, 1970; Lucas and Stankey, 1974; O'Riordan, 1977; Sheridan, 1979; Wagar, 1977).

Relatively few studies have specifically estimated the (negative) value of noise externalities on other recreators. One exception is a recent analysis conducted by the Federal Aviation Administration (FAA) to estimate the benefits of a regulation to restrict commercial air tours in Grand Canyon National Park (GRCA) (FAA, 2000). Using visitor-day value estimates from existing studies ranging from $37 to $92 (for backcountry, river, and other users of the park), the analysis assumed that these visitor-day values would be reduced in

relation to the how much aircraft noise interfered with the enjoyment of GRCA. Information about how aircraft noise affected different recreators was provided by a separate survey study of GRCA visitors. The survey found, for example, that for backcountry visitors 21 percent were "slightly" affected and 2.5 percent were "extremely" affected by the aircraft noise. In the FAA analysis, visitor value-days were assumed to be reduced by 20 to 80 percent depending on the percentage of respondents who indicated that their enjoyment of the park was "slightly," "moderately," "very," or "extremely" affected by the noise.

Another example of such a study that focuses specifically on the noise impacts of PWC is one that has examined the losses that PWC users impose on other beach recreators (Komanoff and Shaw, 2000). This study assumed that an average beach day (per person) is worth between $10 for a popular beach and $30 for a secluded one and that each 10 dB increase in background noise decreases these values by 10 percent. The assumptions about the size of the decrease in value from increases in noise come from studies on the increased property values for houses in quiet neighborhoods. Assuming also that each 1 dB noise level increment reduces the value of a beach day by 1 percent, the study found that beachgoers suffer an average loss in recreation value of between $0.50 and $7.40 per jet ski cluster (1.6 jet skis over the course of a day) per person per day.

Other evidence regarding the noise-related losses imposed by PWC can be gleaned from studies that have examined the effects of congestion on recreation values. In these studies, congestion is often measured as the number of encounters with other recreators, which may be thought of as being roughly equivalent to hearing the sound of PWC. For example, in a study of backcountry recreators in the Caribou-Speckled Mountain Wilderness in Maine, Michael and Reiling (1997) found that weekend visitors experienced losses of $22.3 (in 1990 dollars) per visit if they encountered more groups than expected.

Visibility Improvements. Several studies by the NPS and others have demonstrated the importance of visual air quality for visitors' (and nonvisitors') enjoyment and appreciation of national parks. Nevertheless, visual air quality has been and continues to be threatened at many national parks across the country. Emissions

from PWC in these parks are one of many potential (albeit, a relatively small) sources of these visibility impairments.

Although visibility effects can be characterized and measured in several different ways, "regional haze," which uniformly reduces visual range and therefore impairs the appreciation of natural vistas, has been a particular source of concern. The primary contributors to regional haze and visibility impairments in general are small particles (particulate matter or PM) in the atmosphere that scatter and absorb light. There are several different sources and types of particles in the environment; however, sulfates (and to a lesser extent nitrates), primarily from the combustion of fuels, are the largest contributors to visibility reduction, especially in the eastern portions of the U.S. (Malm, 1999). Nationwide, the largest sources of sulfur dioxide emissions that contribute to sulfates in the atmosphere are power plants and other industrial sources. Mobile sources, such as cars, trucks, and buses (and PWC), account for the largest portion of NO_x emissions, which contribute to nitrates.

Emissions factors per hour are not available for PWC but because PWC are powered by the same type (two-stroke) of engine as snowmobiles, snowmobile emissions factors may serve as a reasonable proxy. Table B-2 compares typical emissions rates for snowmobiles and other vehicles for NO_x and PM. These are the pollutants that are the most likely contributors to visibility impairments from PWC emissions. These emissions rates vary greatly across types and uses of these vehicles; however, the table shows that PM emissions for snowmobiles are particularly high relative to automobiles. The California Air Resources Board found that a 7-hour ride on a PWC powered by a conventional two-stroke engine produces the same amount of smog-forming emissions as over 100,000 miles driven in a modern passenger car. It should also be noted, however, that automobiles account for a very small portion of PM emissions nationwide.

The estimates in Table B-2 suggest that PWC can be a source of visibility impairment in national parks, but their contribution to overall levels of regional haze in these areas is likely to be negligible. Nevertheless, in high-use areas and periods, they may negatively affect visual air quality in a noticeable way.

Table B-2. Comparative Emissions Factors for Snowmobiles and Other Vehicles: NO_x and PM

	NO_x	PM
Snowmobiles (lbs per 4 hr visit)	0.06	0.2
Automobiles (lbs per 4 hr drive[a])	0.09–0.41	0.02
Diesel buses (lbs per 4 hr drive[a])	3.22	0.26

[a]Assuming an average speed of 25 mph.
Source: NPS, 2000a.

Several studies have investigated U.S. households' values for improvements in visibility at various national parks across the country. All of these studies have found a significant WTP by both users and nonusers for visibility improvements. One study in particular (Chestnut and Rowe, 1990) found that the average household in the southeast United States would be willing to pay $68 (in 1999 dollars) per year for a doubling of the visual range in national parks in the southeast United States.

Human Health Benefits

In addition to NO_x, ozone, and PM, PWC emissions typically contain a number of other pollutants, including CO, a conventional air pollutant that is commonly associated with mobile sources. It also includes a number of potentially toxic HC pollutants—benzene, 1,2-butadiene, formaldehyde, and acetaldehyde—and ammonia. As described in Table B-3, inhalation of these pollutants is associated with a wide variety of potential adverse health effects.

The extent to which the health effects listed in Table B-3 result from PWC emissions depends on the level and duration of exposure. Unfortunately, there is too little data and too much uncertainty to reliably estimate the incidence of these health effects. For comparative purposes, however, Table B-4 compares emissions rates of HCs and CO for snowmobiles (as in Table B-2, snowmobile emissions factors serve as a proxy for those of PWC) and for other vehicles.

The comparisons for CO are particularly relevant since highway vehicles account for over 50 percent of total CO emissions in the country (EPA, 2000b). Although the measures of vehicle use in the emissions factors are different across vehicles, the rates of HC and

Table B-3. Health Effects Associated with Pollutants in PWC Emissions

	Carcinogenic Effects	Other Chronic Health Effects	Acute Health Effects
Particulate matter (PM)	None	Chronic bronchitis	High-level exposure: mortality, acute bronchitis Low-level exposure: cough
Carbon monoxide (CO)	None	Aggravation of cardiovascular disease	High-level exposure: visual and mental impairment
Nitrogen oxides (NO_X)	None	Reduced pulmonary function	High-level exposure: cough, fatigue, nausea Low-level exposure: lung irritation
Benzene	Known human carcinogen	Anemia and immunological disorders	High-level exposure: dizziness, headaches, tremors
1,3-Budatdiene	Probable human carcinogen	Birth defects, kidney and liver disease	High-level exposure: neurological damage, nausea, headache Low-level exposure: eye, nose, throat irritation
Formaldehyde	Probable human carcinogen	NA	NA
Acetaldehyde	Possible human carcinogen	Anemia	High-level exposure: pulmonary edema, necrosis Low-level exposure: eye, skin, lung irritation
Ammonia	None	NA	High-level exposure: eye and lung irritation

NA = Not available

Sources: EPA, 2000a; EPA, 1999a.

Table B-4. Comparative Emissions Factors for Snowmobiles and Other Vehicles: HC and CO

	HC	CO
Snowmobiles (lbs per 4 hr visit)	19.84	54.45
Automobiles (lbs per 4 hr drive[a])	0.09–0.44	0.75–3.24
Diesel buses (lbs per 4 hr drive[a])	1.23	4.45

[a]Assuming an average speed of 25 mph.

Source: NPS, 2000a.

CO emissions for snowmobiles are distinctly higher than for automobiles and diesel buses. As a result, national park visitors recreating near areas where PWC use is permitted may be exposed to particularly high levels of CO and certain HCs.

Restrictions on PWC use in national parks could potentially reduce harmful exposures to park visitors and workers, particularly for individuals who spend extended periods in high-use areas. The benefits of these restrictions can be expressed as the value of reductions in the incidence (i.e., the number of cases avoided) of harmful health effects, in particular those effects described in Table B-3. As previously mentioned, the total number of avoided health effects is not known; however, using information from a recent EPA study of the benefits of air pollution regulations (EPA, 1997), Table B-5 provides a summary of "unit" values for selected health effects. Based on a review and synthesis of several health valuation studies, these values represent best estimates of individuals' average WTP to avoid a single case of the health effect. In the absence of more complete information on the total health benefits of reducing PWC use, these values provide a rough sense of the magnitude and relative size of the benefits associated with avoiding specific health effects that may result from acute exposures.

Table B-5. Unit Values for Selected Health Effects

Health Effect	Unit Value (mean estimate) (1999$)[a]
Acute bronchitis	$57
Acute asthma	$41
Acute respiratory symptoms	$23
Shortness of breath (one day)	$6.8

[a]All amounts inflated using the consumer price index available from the U.S. Bureau of Labor Statistics (BLS, 2000).

Ecosystem Protection Benefits

To the extent that damages to park ecosystems occur, their cumulative effect is to reduce the "ecological services" that these systems provide to individuals and households across the country. National park ecosystems are particularly valued for their unique

biological, cultural, and geological resources and the recreational and other services they provide. A vast majority of park visitors (i.e., users) experience and enjoy the natural systems of the park through a wide variety of recreational activities (wildlife viewing, hiking, fishing, as well as using PWC). However, even individuals who are not park visitors (i.e., nonusers) can benefit from the knowledge that park resources are being protected and preserved. These nonuse values can stem from the desire to ensure others' enjoyment (both current and future generations) or from a sense that these resources have some intrinsic value. Evidence of such nonuse values for park protection is provided in studies that have documented significant WTP by nonusers for improved air quality at parks (e.g., Chestnut and Rowe, 1990) and, more generally, for the protection of unique species and ecosystems (see, for example, Pearce and Moran, 1994, for a review of such studies). Restrictions on PWC use in national parks can therefore provide benefits to both users and nonusers in a number of ways by protecting the parks' ecological resources.

B.1.2 Nonenvironmental Benefits

Restrictions on PWC use in national parks can also improve societal welfare in ways that are not directly related to environmental quality in and around the parks. These potential nonenvironmental benefits are described below.

Public Safety Benefits

With the increase in PWC use in recent years has come an increased concern relating to the health and safety of operators, swimmers, snorkels, divers, and other boaters. A study conducted by the National Transportation Safety Board (NTSB) in 1998 revealed that although recreational boating fatalities have been declining, PWC related fatalities have increased in recent years (NTSB, 1998). PWC accident statistics provided by the U.S. Coast Guard supports the increase in PWC-related fatalities. Within the U.S. five PWC-related fatalities occurred in 1987 and 68 PWC-related fatalities occurred in 2000. However, the peak occurred in 1997, with 84 PWC-related fatalities. Since 1997, PWC-related accidents, injuries, and fatalities have decreased. Following this same pattern, the percentage of PWC out of all boats involved in accidents have decreased from 36.3 percent in 1996 to 29.6 percent in 2000. The increases and decreases in PWC

accidents, injuries, and fatalities are comparative to the number of PWC sales and number of PWC owned (U.S. Coast Guard, 2001).

Restrictions on PWC use in national parks would certainly reduce the number of such incidents in the parks.[1] The primary beneficiaries would be the PWC users themselves, whose safety would be protected; however, these benefits may be implicitly accounted for in the consumer surplus changes (see Section B.2) that these recreators experience as a result of the restrictions.[2] Other summer recreators (non-PWC) might also benefit if they would otherwise be at risk of being involved in accidents with PWC. In addition, PWC accidents can impose costs on NPS and other local state and local government agencies that are responsible for providing medical, rescue, and related assistance. Reductions in PWC accidents in national parks would therefore allow some of the resources devoted to these activities to be diverted to other publicly beneficial uses.

Avoided Infrastructure Costs

Allowing PWC in national parks requires NPS to develop, maintain, and operate an infrastructure to support these activities. In particular launch sites and buoys must be designated, maintained, and monitored. The costs associated with these activities vary widely across parks, depending on the physical characteristics of the parks and the level of PWC use permitted.

By restricting PWC use, some of these infrastructure-related costs can be avoided or reduced. As a result some of the resources devoted to these activities can also be diverted to other publicly beneficial uses.

[1] The benefits of these reductions may be offset to some degree by increased PWC usage and accidents in areas outside the parks.

[2] To the extent that PWC users are aware of the safety risks they face, the potential losses to themselves from accidents should already be factored into their consumer surplus from using a PWC. This implies that the safety benefits to these individuals from reducing PWC use are implicitly accounted for (i.e., deducted from) the consumer surplus losses to these recreators.

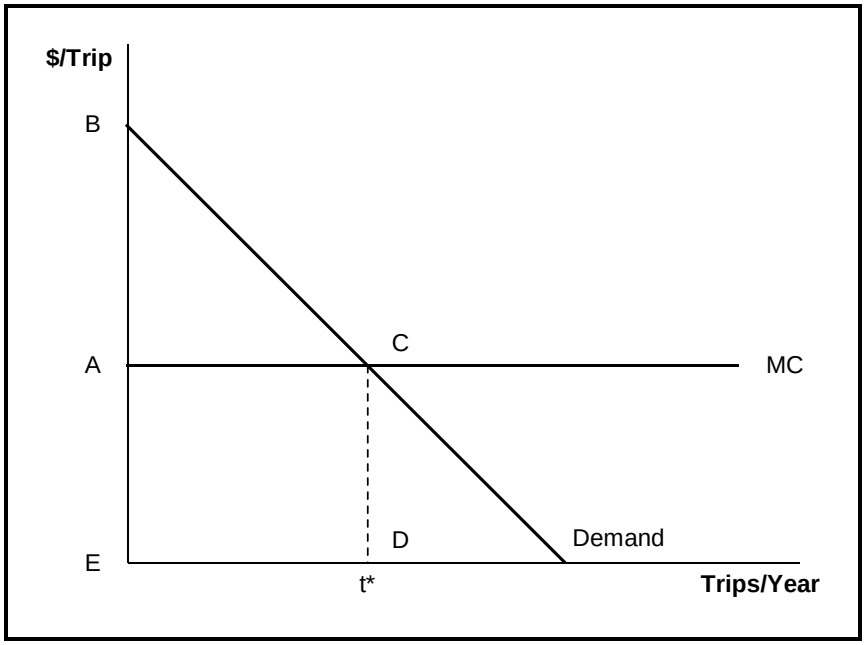
B.2 SOCIAL COSTS OF PWC RESTRICTIONS

The primary losses associated with PWC use restrictions in national parks will accrue to

- ➤ PWC users, in particular individuals who will not PWC in the park as a direct result of the restrictions, and
- ➤ providers of PWC-related services for park visitors.

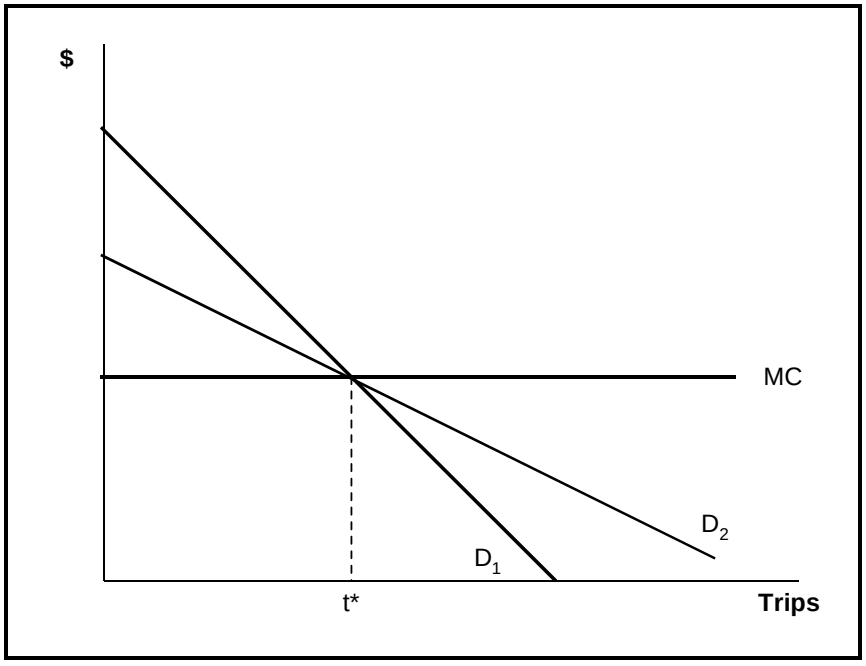
The welfare losses to individual consumers (PWC riders) are measured by their loss in consumer surplus. Consumer surplus is measured as the difference between the total cost of a product or activity to the consumer and the total amount the individual would be willing to pay for that activity. In the context of recreation activities, Figure B-1 depicts an individual demand curve for PWC trips, the marginal cost of a trip (MC, assumed to be constant), and the optimal number of trips per year, t*. The triangle ABC measures the consumer surplus associated with this optimal number of trips—the difference between what the individual paid for the trips, ACDE, and the total WTP for the trips (the area underneath the demand curve), EBCD.

Figure B-1. Consumer Surplus



The extent of the welfare loss to an individual rider depends crucially on the availability of substitute activities. Figure B-2 depicts two alternative demand curves for PWC trips to a particular waterbody. The slope of the demand curve reflects the number of substitute activities available to a particular individual and the preferences of that individual toward those substitutes. The flatter demand curve, D_2, indicates that this individual has a variety of close substitutes for PWC use in this area (these substitutes could include PWC riding in a different area or participating in a different activity such as motorboating). The individual with the steeper demand curve, D_1, has fewer substitute activities he/she enjoys as much as using his/her PWC in this waterbody. If both individuals choose the same number of trips, as in Figure B-2, the person with the steeper demand curve, D_1 (fewer substitutes for PWC use) receives greater consumer surplus from use in this particular waterbody and thus will experience a greater loss in welfare if the waterbody is closed.

Figure B-2. Consumer Surplus and Substitute Activities



The change in welfare for businesses is measured by producer surplus, or the area AP*B in Figure B-3, where P* is the market price of the good, for example a PWC rental. Producer surplus measures the difference between total revenue and variable costs. If the firms face an upward- sloping marginal variable cost (MC) curve, then a decrease in demand, indicated in Figure B-4 from D to D' will result in a lower producer surplus for PWC rental companies.

Figure B-3. Producer Surplus

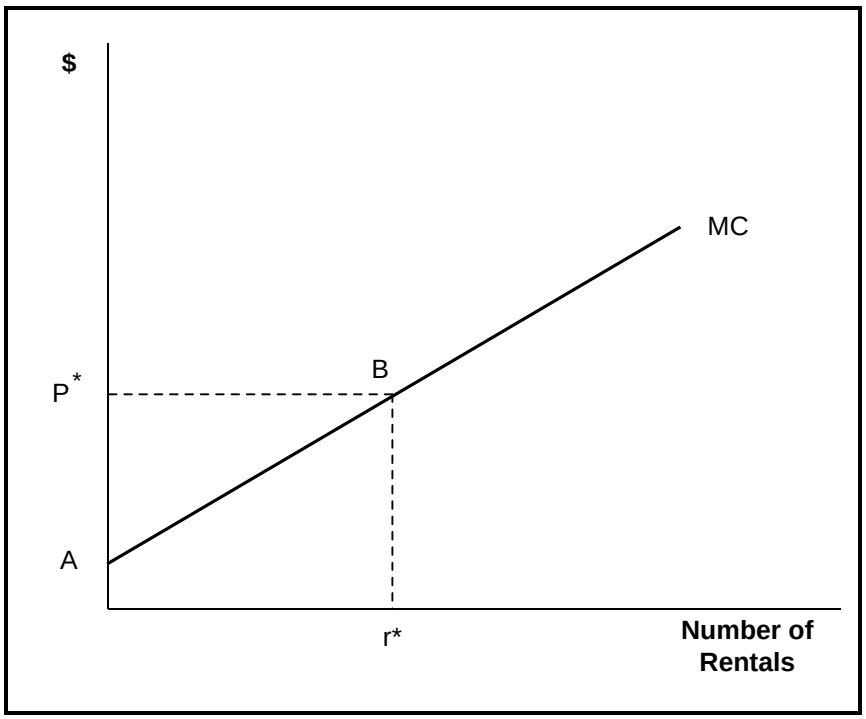
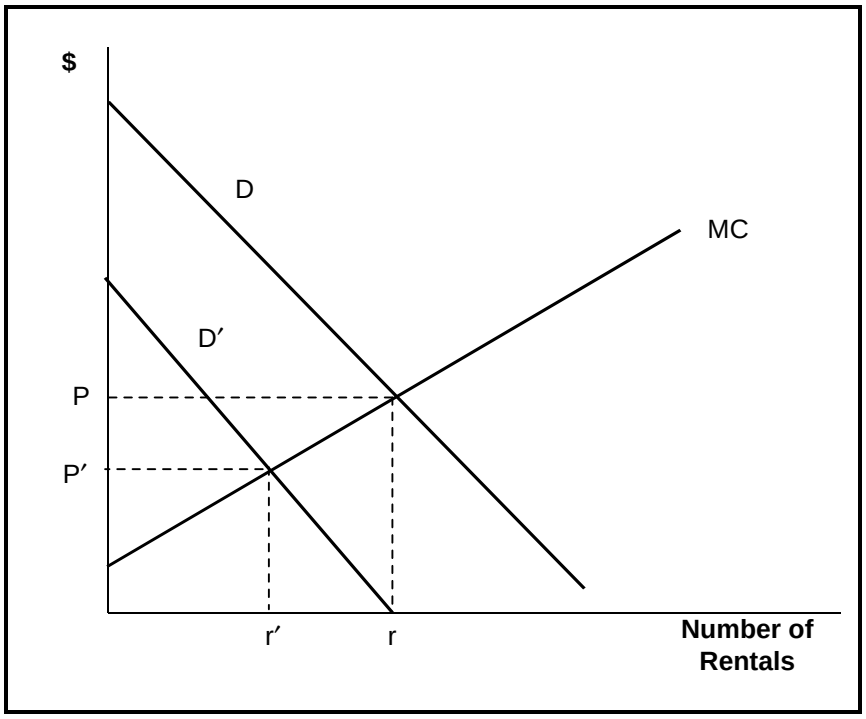


Figure B-4. Producer Surplus and a Change in Demand



If PWC riding decreases as a result of the regulation, then the suppliers of PWC and other tourism-related services will be affected, including rentals and sales of PWC and PWC accessories, lodging, meals, and other tourism-related expenditures. If demand for other types of recreation related rentals increases, then some businesses may experience an offsetting increase in producer surplus.